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CLASSIFICATION CANCELLED
BY AUTHORITY OF CG, AMC
DATE: 30 Sept 46
Peter K. Clausen
Capt USA

AN 01-60JF-1

PILOT'S HANDBOOK

FOR

MODEL P-51H-1, -5, -10

AIRPLANES

Commanding Officers will be responsible for bringing this Technical Order to the attention of all pilots cleared for operation of the subject aircraft as well as those undergoing Transition Flying Training as contemplated in AAF regulation 50-16.

Appendix I of this publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

Published under joint authority of the Commanding General, Army Air Forces, and the Chief of the Bureau of Aeronautics.

REVISION NOTICE

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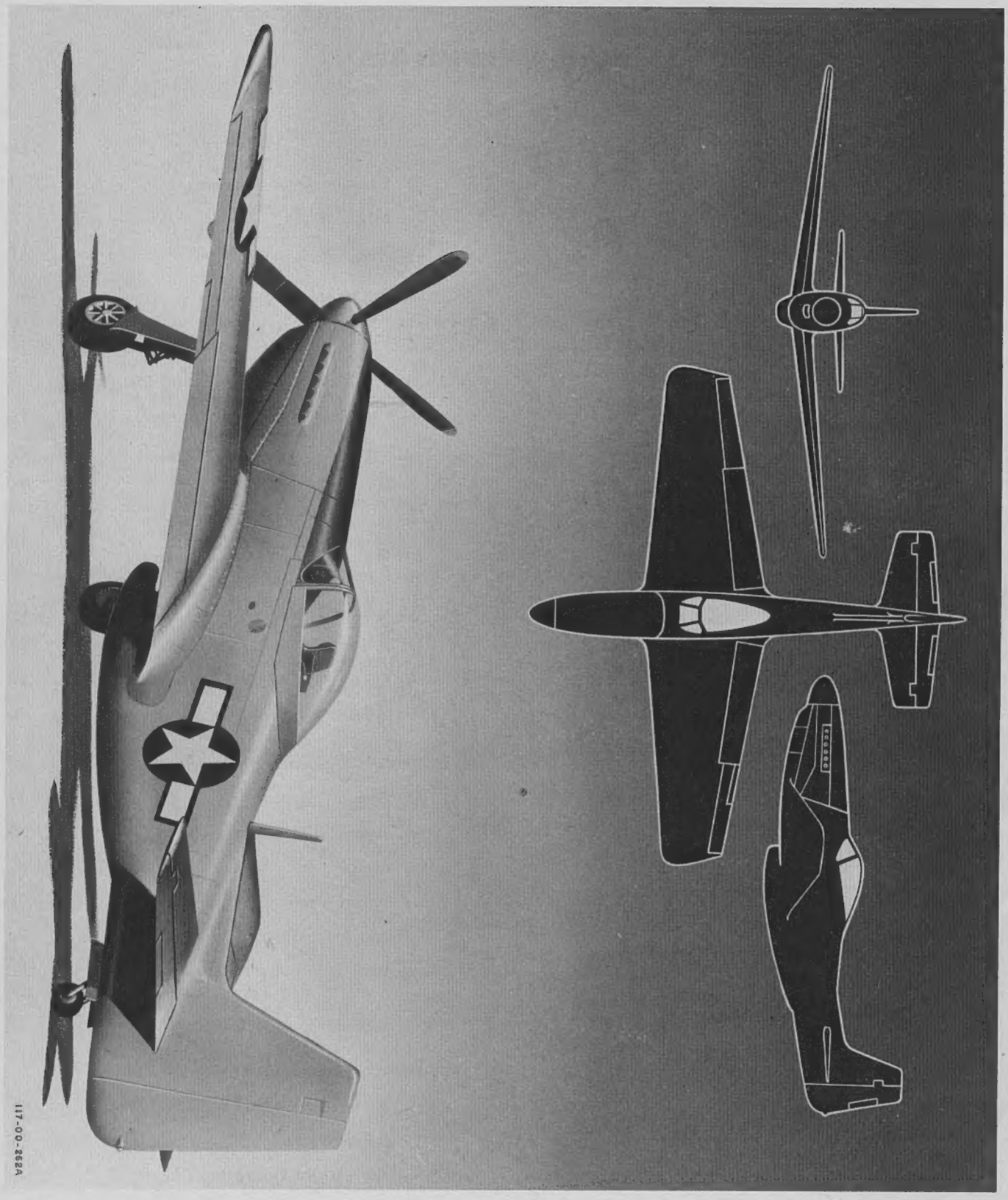


Figure 1—Three-quarter Rear View of Airplane

Section I

DESCRIPTION

1. GENERAL.

The North American P-51H Fighter Airplane is a single-place, lightweight monoplane, powered by a V-1650-9 liquid-cooled engine. Although similar to other P-51 Models in outward appearance, this airplane is of an entirely new design. It has a wing span of 37 feet, 3/16 inch, and a length of 33 feet, 4 inches. The airplane is armed with six .50-caliber machine guns, has wing racks to carry bombs, depth charges, chemical tanks, or combat fuel tanks, and is equipped to mount rockets. Figure 25 shows the armor plate protection.

2. BLOCK NUMBERING SYSTEM.

To clarify the relationship between various groups of serial numbers used on P-51H Airplanes, the following block numbering system has been adopted:

BLOCK NUMBER	SERIAL NUMBERS INCLUDED
P-51H-1-NA	AAF44-64160 to 64179
P-51H-5-NA	AAF44-64180 to 64459
P-51H-10-NA	AAF44-64460 to 64759

3. FLIGHT CONTROLS.

The ailerons, elevators, and rudder are conventionally operated by a control stick and rudder pedals. The surface control lock is forward of the base of the control stick on the center control pedestal. Trim tab controls (a wheel for the elevator, and knobs for the rudder and left aileron tabs) and the flap control lever are on the left side of the cockpit. The flaps move simultaneously with the movement of the control and remain locked in the selected position until the control is moved to another setting. A relief valve incorporated in the wing flap system prevents the flaps from being lowered when the airplane is flying at too great an airspeed. When the air pressure against the flaps becomes greater than the relief pressure, the flaps will automatically retract to a position where air force and hydraulic pressure are in balance. If the flap control lever is forced in an attempt to obtain a greater flap angle when flying at high speeds it will cause hydraulic fluid to be by-passed through the relief valve. If this condition is created frequently, serious damage to the internal parts of the hydraulic units may be caused by the heat produced, or by the continuous flow of hydraulic fluid at maximum pressure.

4. LANDING GEAR CONTROLS.

a. GENERAL.—The hydraulically operated landing gear system is controlled by a lever on the left side of the cockpit. The control lever has three positions, "DOWN," "NEUTRAL," and "UP," and is kept in "NEUTRAL" except when the gear is being raised or lowered. The main gear up-latches and the fairing door up-latches are in the locked position and the hydraulic pump is unloaded only when the control handle is in "NEUTRAL." When the control stick is in normal position, the tail wheel is linked to the rudder pedals and is steerable 6 degrees right or left. With the control stick forward, the tail wheel is unlocked and full-swiveling. An emergency lowering handle is on the cockpit floor by the pilot's left foot. Pulling the handle releases the gear from the up position. To prevent a change of sequence in the extension or retraction cycle, movement of the control lever must never be reversed but must be moved to the full "UP" or "DOWN" position and left there until the gear is locked and the fairing doors are closed. Reversing the movement will interrupt the operating sequence and may result in the door interfering with the gear. A period of from 10 to 15 seconds is required for the gear to completely extend and lock and the fairing doors to close before the control lever may be moved to the "NEUTRAL" position.

b. LANDING GEAR WARNING LIGHTS AND HORN.—A green light and a red light are provided on the front switch panel, and a horn aft of the pilot's seat, for continuous indication of fairing doors and main landing gear positions. The warning lights do not indicate the position of the tail wheel. All lights are equipped with dimmer masks and are push-to-test type indicators. The signals operate in the following manner:

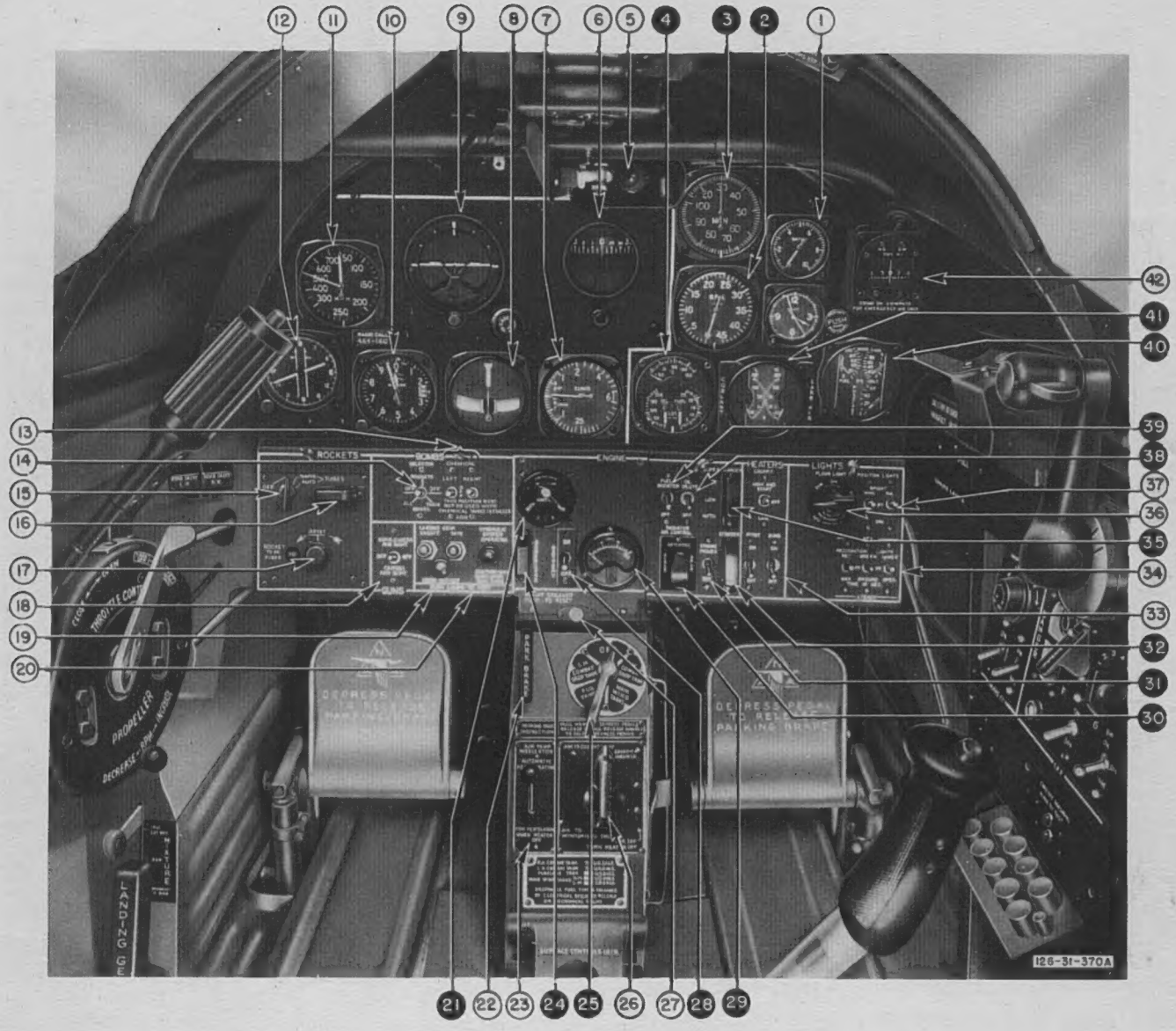
RED LIGHT—The red indicator illuminates whenever an extension or retraction cycle has been started and will remain on until the gear is locked in the extended or retracted position. During flight the red light will also illuminate to indicate an unsafe condition if the fairing doors open.

GREEN LIGHT—The green indicator illuminates immediately after the gear is locked in the full extended position and remains on until the gear is retracted. It does not function, however, after the completion of a retraction cycle, nor indicate the position of the fairing doors at any time.

Note

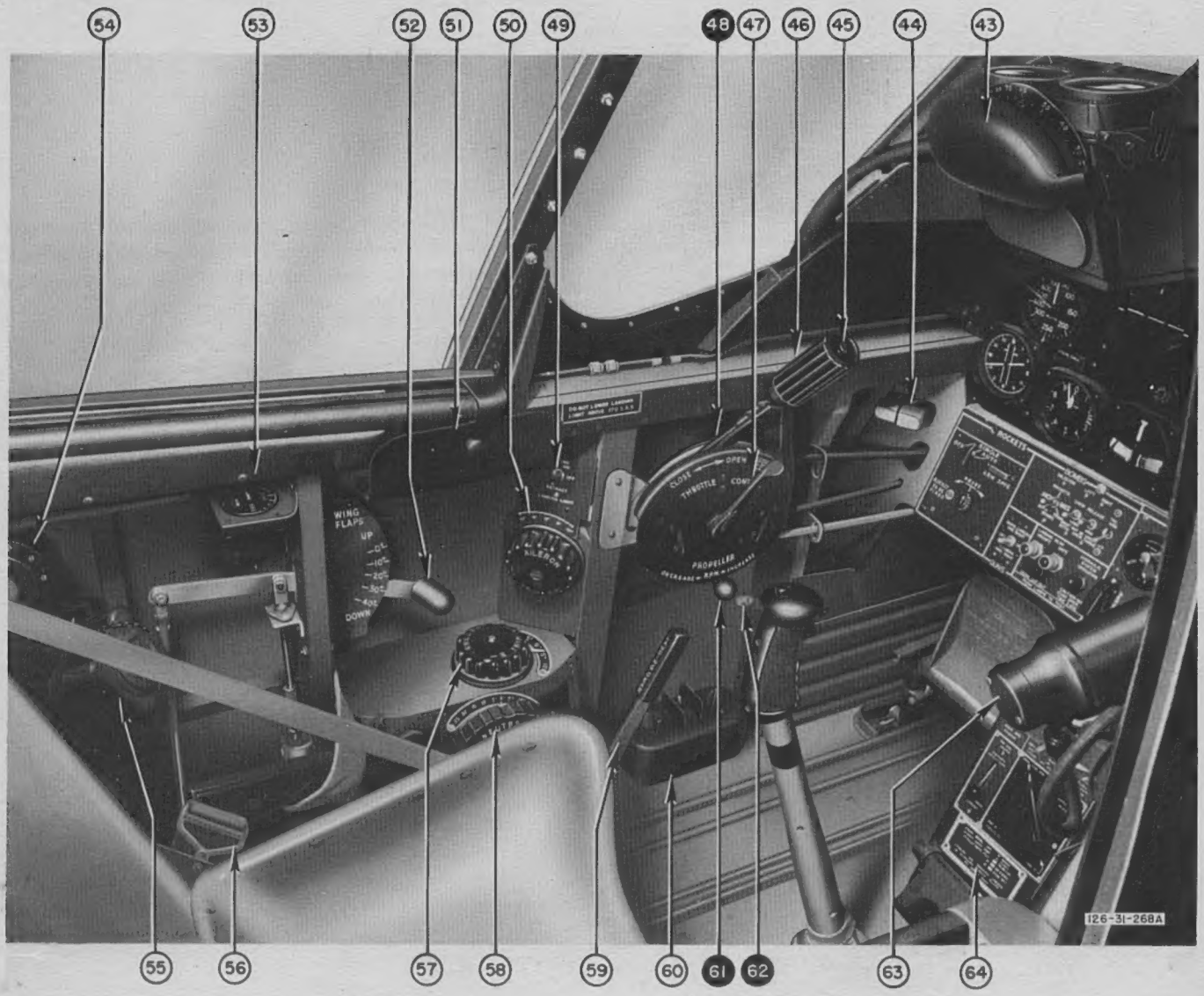
The hydraulic pressure amber indicator illuminates following each extension or retraction cycle after pressure in the system has built up to approximately 1500 psi. This is a reasonably certain indication that the operating cycle has been completed (with fairing doors closed) and the control lever may be returned to "NEUTRAL."

HORN.—The horn functions whenever the gear is up and locked or down and unlocked, and the throttle is retarded below the minimum cruising power position. It will continue to function until the gear is locked in



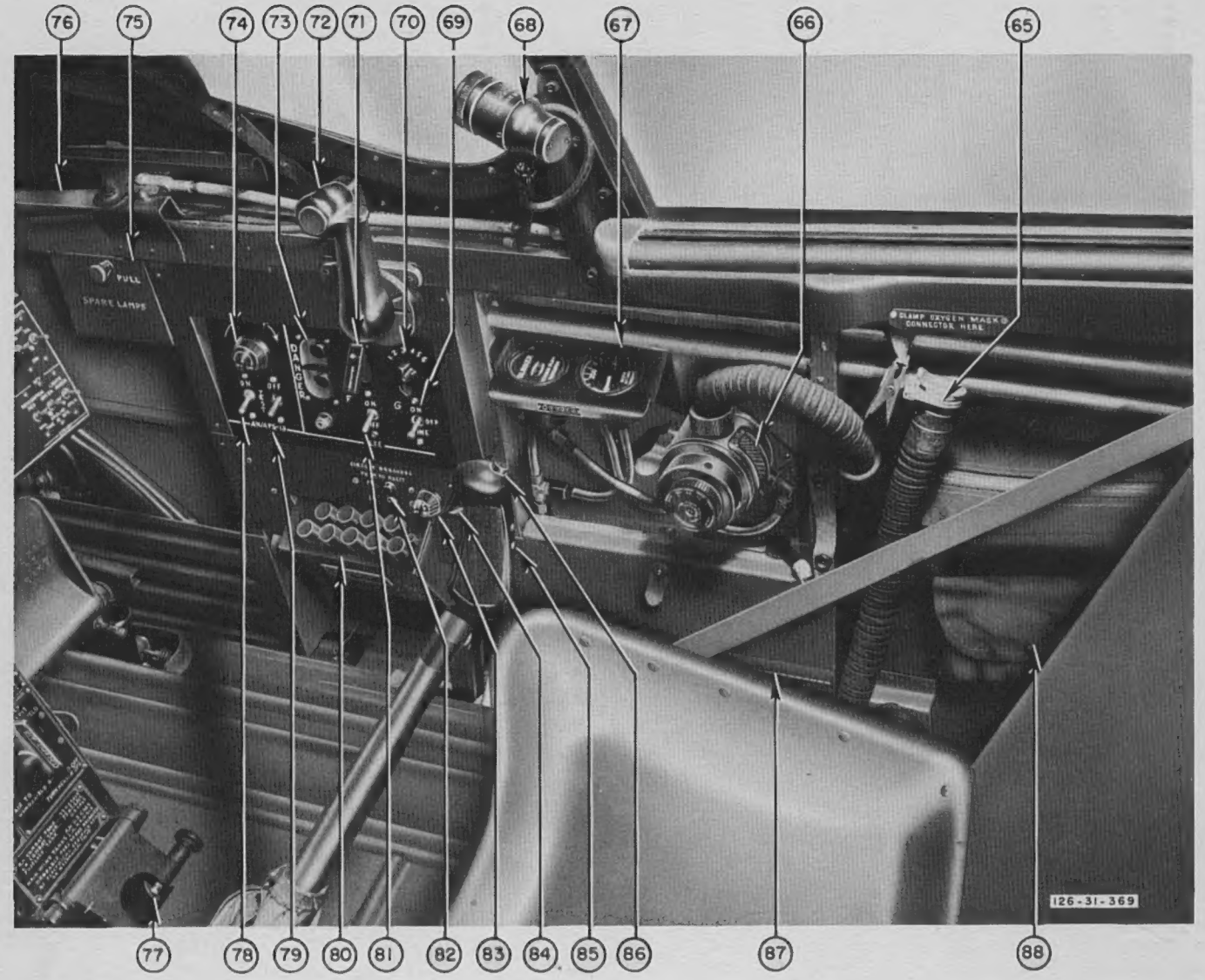
1. Suction Gage
2. Tachometer
3. Manifold Pressure Gage
4. Oil Temperature and Fuel and Oil Pressure Gage
5. Fluorescent Light
6. Directional Gyro
7. Rate-of-Climb Indicator
8. Bank-and-Turn Indicator
9. Flight Indicator
10. Altimeter
11. Airspeed Indicator
12. Remote-Indicating Compass
13. Arming Switches
14. Bombs and Rockets Control Switch
15. Rockets Selector Control
16. Rockets Arming Switch
17. Rockets Reset Switch
18. Guns, Camera, and Sight Switch
19. Landing Gear Warning Indicators
20. Hydraulic System Indicator Light
21. Ignition Switch
22. Parking Brake Control
23. Cockpit Heater Control
24. Generator-disconnect Switch
25. Fuel Selector Control
26. Cockpit Air Control
27. Circuit-breaker Reset Control
28. Battery-disconnect Switch
29. Ammeter
30. Radiator Air Control
31. Primer Switch
32. Starter Switch
33. Heater Switches
34. Recognition Light Switches
35. Supercharger Control Switch
36. Fluorescent Light Switch
37. Position Light Switches
38. Oil Dilution Switch
39. Fuel Booster Pump Switch
40. Fuel Gage
41. Coolant and Carburetor Air Temperature Gage
42. Stand-by Compass

Figure 2—Cockpit—Forward View



43. K-14 Gunsight
44. Bomb Salvo Control Handles
45. Radio Transmit-Receive Switch
46. Gunsight Twist-grip Control
47. Throttle Control Friction Lock
48. Throttle Control
49. Landing Light Switch
50. Aileron Trim Tab Control
51. Arm Rest
52. Wing Flap Control
53. Hydraulic Pressure Gage
54. Landing Gear Warning Horn
55. Signal Pistol Mount
56. Safety Belt
57. Rudder Trim Tab Control
58. Elevator Trim Tab Control
59. Landing Gear Control
60. Gunsight Selector-Dimmer Control
61. Propeller Control
62. Mixture Control
63. Cockpit Light
64. Fuel System Placard

Figure 3—Cockpit—Left Side



65. Oxygen Mask Connection
66. Oxygen Regulator
67. Oxygen Instruments
68. Cockpit Light
69. I.F.F. Radio G Band Control Switch
70. I.F.F. Radio Selector Switch
71. I.F.F. Emergency Switch
72. Canopy Control Handle
73. Detonator Switches
74. AN/APS-13 Radio Volume Control
75. Spare Lamp Stowage
76. Canopy Emergency Release Handle
77. Control Surfaces Lock
78. AN/APS-13 Radio Test Switch
79. AN/APS-13 Radio Control Switch
80. AN/ARC-3 Radio Control Box
81. I.F.F. Radio F Band Control Switch
82. AN/ARC-3 Circuit Breakers
83. AN/ARC-3 Volume Control
84. Guns and Camera Trigger Switch
85. Surface Control Stick
86. Bomb Release Switch
87. Data Case
88. First-aid Kit

Figure 4—Cockpit—Right Side

the full extended position or until the throttle is advanced beyond the minimum cruising power position.

Note

A horn cutout switch is provided on the front switch panel below the indicator lights. If the cutout switch is used, the horn circuit will be automatically reset when the throttle is advanced beyond the minimum cruising power position.

5. BRAKE CONTROLS.

The hydraulic brakes are controlled by two pedals, integral with the rudder pedals, actuating two master brake cylinders. Fluid for the brake system is obtained from the hydraulic reservoir. The parking brake control is at the top of the center control pedestal. Pressing the brake pedal releases the parking brakes.

6. HYDRAULIC SYSTEM CONTROLS.

The wing flaps and the landing gear are operated by the hydraulic system. An amber light on the front switch panel illuminates when the hydraulic system is operating above approximately 1500 psi.

CAUTION

Do not operate the hydraulic system continuously for more than 3 minutes.

7. ELECTRICAL CONTROLS.

Most of the electrical control switches are on the front switch panel *(figure 8)* and on the right-hand switch panel. The retractable landing light switch is on the left side of the cockpit and the push-to-talk button is on the throttle grip. *(See figure 3.)* Spare bulbs are in a compartment on the forward right-hand side of the cockpit. The external power receptacle, on the left side of the fuselage in the aft wing fillet, is accessible through a spring-loaded door.

Note

Use external power instead of the airplane battery to start the engine, and to operate the electrical system while the airplane is on the ground.

8. FUEL SYSTEM CONTROLS.

The fuel selector control handle, at the top of the center control pedestal, has five positions: "MAIN WING TANKS,"

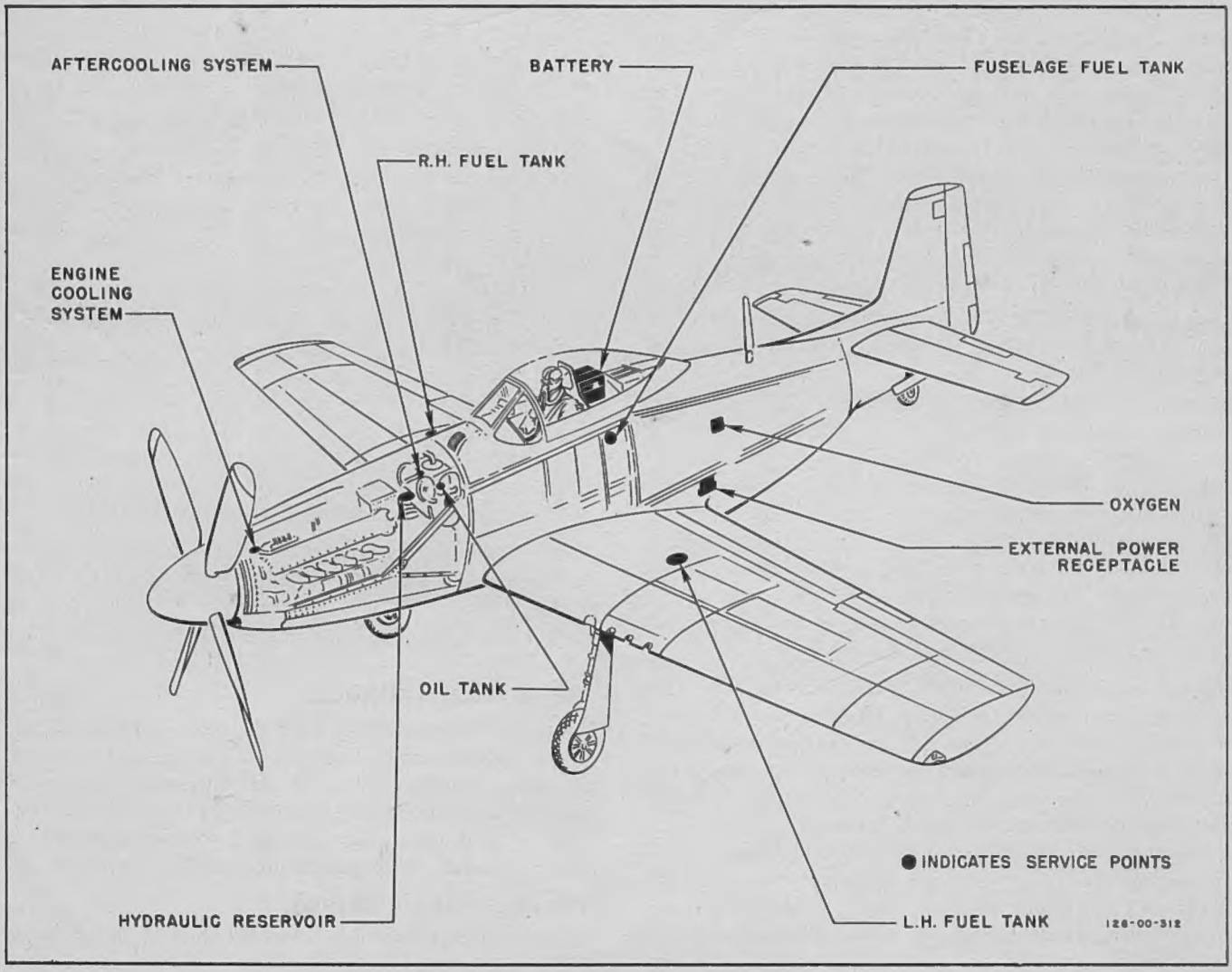


Figure 5—Interior Arrangement

"FUS. TANK," "L. H. COMBAT DROP TANK," "R. H. COMBAT DROP TANK," and "OFF." The fuel tanks and lines are shown in figure 7. Fuel from the left main wing tank flows by gravity to the right tank booster pump compartment. The booster pumps in the right main tank and in the fuselage tank are controlled by a master booster pump switch on the front switch panel. Turning the fuel selector control, with the booster pump switch "ON," starts the booster pump in the fuel compartment indicated. The carburetor vapor return line is routed to the right wing tank.

Note

The left wing tank and the fuselage tank can be removed to reduce the gross weight when operating under conditions where less fuel is required.

The drop tanks are pressurized to permit satisfactory operation up to 30,000 feet altitude. An electrical primer switch is located on the front switch panel.

9. INDUCTION SYSTEM CONTROLS.

a. SUPERCHARGER CONTROLS.—The supercharger is shifted automatically by a sealed dual-element aneroid switch vented to the carburetor air scoop. One switch in the aneroid case is calibrated to give best performance throughout normal ranges of operation. An alternate switch, controlled by the water injection switch, is calibrated to give best performance at War Emergency Ratings. A toggle switch on the front switch panel disconnects the aneroid switches in an emergency or for ground check. The toggle switch has three positions: "AUTO" for all normal operation, "LOW" for long-range cruising in low blower at high altitude, and a momentary "HIGH" for use in ground testing the engine. A guard holds this switch in the "AUTO" position.

b. CARBURETOR AIR CONTROLS.—The air induction system supplies the carburetor with ram air, unrammed filtered air, or warm unrammed air from the engine compartment. The control lever, on the floor at the right side of the seat, moves as shown in figure 24. When the control is placed in the "RAMMED" position, only cold ram air enters the carburetor. When the control is moved back to the "FILTERED" position, air enters the induction system through two filter units in the forward section of the engine compartment. Moving the control forward, as shown in the lower part of figure 24, admits engine compartment air as desired. If the air duct becomes obstructed by ice, engine compartment air will enter the induction system automatically.

c. WATER INJECTION SYSTEM CONTROLS.—The water injection system includes a 10-gallon water supply. A water injection switch above the engine control quadrant and a microswitch incorporated in the quadrant operate the system. When the water injection switch is moved to "ON," the circuit between the quadrant microswitch and the water injection pump is closed, the alternate position of the supercharger aneroid is cut in, and the automatic coolant control is changed to a higher allowable range. When the throttle control lever is advanced through the take-off stop (with the water injection switch "ON") to approximately 67 in. Hg manifold pressure, the quadrant microswitch completes the circuit starting the pump which provides water for injection into the induction system. At the same time, water pressure resets the Simmonds control unit to permit manifold pressures up to 80 in. Hg. When water pressure fails or the water supply is exhausted, the reset mechanism on the Simmonds control automatically returns to its normal position, thereby decreasing the manifold pressure to a maximum of 67 in. Hg. See section II, paragraph 13. *b.* for use of war emergency power.

10. OIL SYSTEM CONTROLS.

Engine oil is cooled by a heat exchanger utilizing coolant liquid from the aftercooling system to transfer the oil heat to the aftercooler radiator. The oil temperature is regulated by a thermostatically controlled valve. The oil dilution system controlling switch is located on the front switch panel.

11. THROTTLE CONTROL.

The throttle control lever, at the top of the engine control quadrant is connected to a Simmonds control unit (manifold pressure regulator) on the engine. At power settings above approximately 25 in. Hg, the control unit automatically maintains a constant manifold pressure (as selected by the throttle lever) irrespective of altitude, airplane attitude, and supercharger speeds up to the critical altitude of the engine. Below approximately 25 in. Hg, the unit is manually controlled and the manifold pressure is directly affected by changes in altitude, attitude, and supercharger speed.

If the operating oil supply to the Simmonds control should fail, the unit becomes fully manual over the entire range of manifold pressures up to approximately 52 in. Hg which is the maximum manifold pressure obtainable at sea level in this condition.

To obtain the take-off manifold pressure of 61 in. Hg, move the throttle to the take-off stop. War emergency power is obtained by moving the throttle control through the safety at the take-off stop. As the throttle is moved to a position which will give 67 in. Hg manifold pressure, a microswitch sets the water injection pump in operation, if the water injection switch is "ON." The Simmonds control automatically limits engine operation to a maximum of 67 in. Hg if the water supply is exhausted or the water pressure fails.

A "twist" grip, on the lever, operates the K-14A or K-14B gun sight range compensator, and a push-to-talk button for radio transmission is on the end of the control handle. A throttle locking lever is on the face of the engine control quadrant.

12. MIXTURE CONTROL.

A mixture control lever is on the center control pedestal in late airplanes and on the left side of the cockpit below the engine control quadrant in early airplanes. The control has two positions: "IDLE CUT OFF" and "RUN." The carburetor is fully automatic, ensuring correct mixture for all operating conditions when the mixture control is in "RUN."

13. PROPELLER CONTROL.

The propeller control is below the throttle on the lower half of the engine control quadrant. A friction lock is provided which can be adjusted by the ground crew.

14. COOLANT SYSTEM CONTROLS.

The engine incorporates two independent cooling systems: one cools the engine, and the other cools the supercharger fuel-air mixture and engine oil, through a thermostatically controlled heat exchanger. Each system has a separate pump and expansion tank. The engine cooling system radiator and the aftercooling system radiator are constructed as a unit, which is located in the air scoop assembly. A thermostatically controlled outlet flap regulates the flow of air through the radiators. The controlling switch for the outlet flap actuator is located on the front switch panel. It has 4 positions: "AUTOMATIC" for all normal operation, "CLOSED" to close the flap in emergency, "OPEN" to open the flap in an emergency, and "OFF" which locks the flap in any desired position. A spring-loaded guard holds the switch in "AUTOMATIC." On late airplanes, a manual emergency release is provided to open the flap in the event of actuator failure. The release is controlled by a lever on the right side of the cockpit floor.

Note

If the coolant radiator flap is lowered too far to permit a safe landing, it will be automatically retracted to a safe position when the tail wheel is extended.

15. ANTI-G SUIT PROVISIONS.

An air pressure outlet connection on the left side of the pilot's seat provides for attachment of the air pressure intake tube of the anti-G suit. Air pressure for the inflation of the anti-G suit bladders is supplied from the exhaust side of the engine-driven vacuum pump, and is regulated by a Type M-2 valve which is a junction point for pressures exerted in both the drop tanks and the anti-G suit. If drop tanks are installed on the airplane, the acceleration force (G load) required to actuate the M-2 valve should be approximately 3 to 3½ G's because of the approximate 5 psi pressure exerted in the tanks. Without the combat tanks installed, the valve should open at 2 G's. After the valve opens, pressure is passed through a regulator valve into the suit in proportion to the G force imposed. For every 1-G acceleration force, a corresponding one psi air pressure is exerted in the anti-G suit.

Section II

NORMAL OPERATING INSTRUCTIONS

1. BEFORE ENTERING COCKPIT.

a. Carefully note the following:

FLIGHT RESTRICTIONS

1. When drop tanks or bombs are installed, only normal flying attitudes are permitted.
2. Inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of the scavenge pumps to function properly in inverted position.
3. "Power-off" spins are permitted, providing such spins are initiated above 12,000 feet.
4. "Power-on" spins are prohibited.
5. Snap rolls are prohibited.

AIRSPEED LIMITATIONS

1. The temporary maximum permissible indicated airspeed at altitudes up to 7000 feet is 505 IAS. See figure 12 for temporary diving speed limits at high altitudes.
2. Do not extend landing gear above 170 IAS.
3. Do not lower landing light above 170 IAS.
4. With 75 or 110-gallon tanks installed, speed is limited to about 400 IAS because of incipient buffeting.

THESE LIMITATIONS MAY BE SUPPLEMENTED OR SUPERSEDED BY INSTRUCTIONS INCLUDED IN SERVICE PUBLICATIONS.

b. Make sure the airplane has been serviced and is ready for flight, particularly in regard to proper quantities of fuel, oil, coolant, hydraulic fluid, and oxygen.

c. Make sure that the total weight of fuel, oil, ammunition, and special equipment carried is suited to the mission to be performed. This is particularly important on combat missions, as the rate of climb of the airplane may vary considerably in relation to the load carried.

d. See that external power supply (if available) is connected. *(See figure 5.)*

Note

Whenever possible, use an external power supply to start the engine. Use airplane's battery in an emergency only.

e. Prior to any ground run-up exceeding 40 in. Hg manifold pressure, make sure that the tail of the airplane is anchored securely to a fixed object. If wheel chocks are available, use them also.

f. The canopy may be opened by pushing in on release button on right side of fuselage near windshield, grasping spring-loaded handle at the forward end of canopy, and sliding canopy aft.

CAUTION

In order to avoid cracking windshield panels, do not grasp windshield frame, when entering or leaving airplane.

2. ON ENTERING COCKPIT.

Note

A pilot's check list and an engine limitations plate are provided in the cockpit for a quick check of airplane operations.

a. Make following standard check for all flights:

(1) Adjust rudder pedals for proper leg length to obtain full brake control while taxiing. Press foot against the lever on the outboard side of each rudder pedal. *(See figure 2.)*

(2) Adjust seat level to obtain full travel of rudder pedals in extreme positions. Adjustment lever is on right side of seat. *(See figure 6.)*

(3) See that ignition switch is "OFF."

(4) Set parking brakes.

(5) See that bomb and gun safety switches are "OFF."

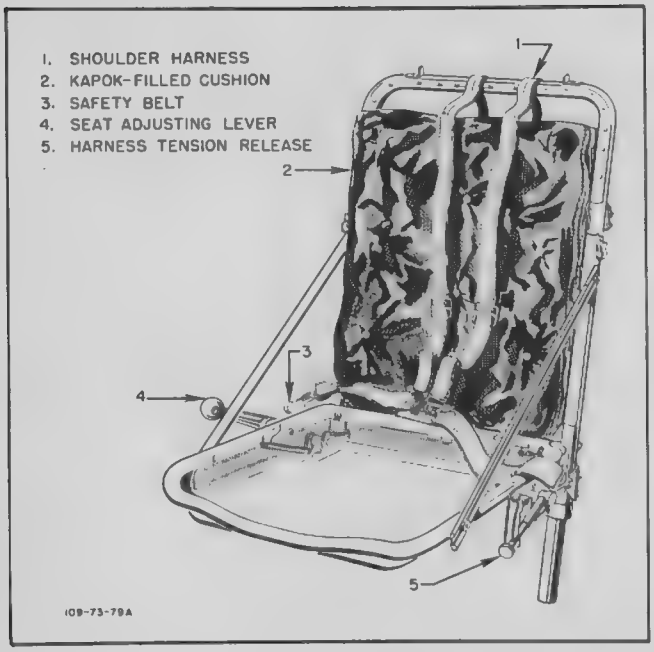


Figure 6—Pilot's Seat

(6) See that landing gear control handle is in "NEUTRAL" position. Green position indicator should be illuminated.

(7) Unlock surface control lock (at base and just forward of control stick) by pulling plunger on right side of lock. Check controls for free and proper movement, watching control surfaces for correct response.

(8) Set altimeter to correct barometric pressure.

(9) Turn gun and camera safety switch to "CAMERA AND SIGHT," gun sight switch on selector-dimmer control to "ON," and test gun sight illumination by rotating dimmer rheostat. Turn gun and camera safety switch and gun sight switch to "OFF."

(10) Check remote-indicating compass for correct reading.

(11) Check landing gear position indicators by pushing in on lamps.

b. Make following special check for night flights:

(1) Test fluorescent instrument light by operating rheostat control. The control for the light is on the front switch panel.

(2) Test position lights by moving switches on front switch panel to "BRIGHT" and "DIM."

(3) Test landing light by turning on switch on left side of cockpit above aileron trim tab control.

(4) Test cockpit swivel light by turning on switch located on lamp housing.

(5) Test operation of recognition lights; the switches are on the switch panel. The keying switch is at the right of the gun sight on the instrument shroud.

Note

Do not operate recognition lights longer than 10 seconds on the ground.

3. FUEL SYSTEM MANAGEMENT.

(See figure 7.)

Note

Turning fuel selector control from one position to another with booster pump switch on, automatically shuts off booster pump on tank formerly used, and starts pump on tank selected.

a. Take off and climb to a safe altitude with fuel selector on "MAIN WING TANKS" and booster pump switch on.

Note

Fuel normally flows through the carburetor vapor return line to the right main tank at approximately one quart per hour. However, if malfunctioning occurs, the rate of flow may be considerably higher.

b. When a safe altitude has been reached, switch fuel selector to either of the drop tank positions and use fuel from these tanks alternately until they are empty.

Note

The drop tanks have no booster pump; a controlled pressure of 5 pounds per square inch is maintained within them by the exhaust side of the vacuum pump.

c. Switch fuel selector back to "MAIN WING TANKS" and use until empty.

d. Switch fuel selector to "FUS. TANK" and use for remainder of flight.

Note

If fuselage tank is nearly empty, a slight nose-heavy condition will be experienced during landing.

4. STARTING ENGINE.

a. Ignition switch "OFF."

b. Mixture control in "IDLE CUT OFF."

c. Have ground personnel turn propeller through approximately eight blades.

d. Turn "ON" generator-disconnect switch. If external power supply is not used, also turn "ON" battery-disconnect switch.

e. Open throttle one inch.

f. Move propeller control to full "INCREASE RPM."

g. See that throttle gate is safety wired.

h. Supercharger blower switch in "AUTO."

i. Turn coolant radiator air control switch, on front switch panel, to "AUTOMATIC."

j. Move carburetor air control on right side of cockpit floor to "RAMMED" ("FILTERED" or "HOT AIR," if required).

k. Turn fuel selector to "MAIN WING TANKS."

l. Switch on booster pump. Check booster output on fuel pressure gage; 10-12 pounds per square inch.

m. Make sure propeller is clear.

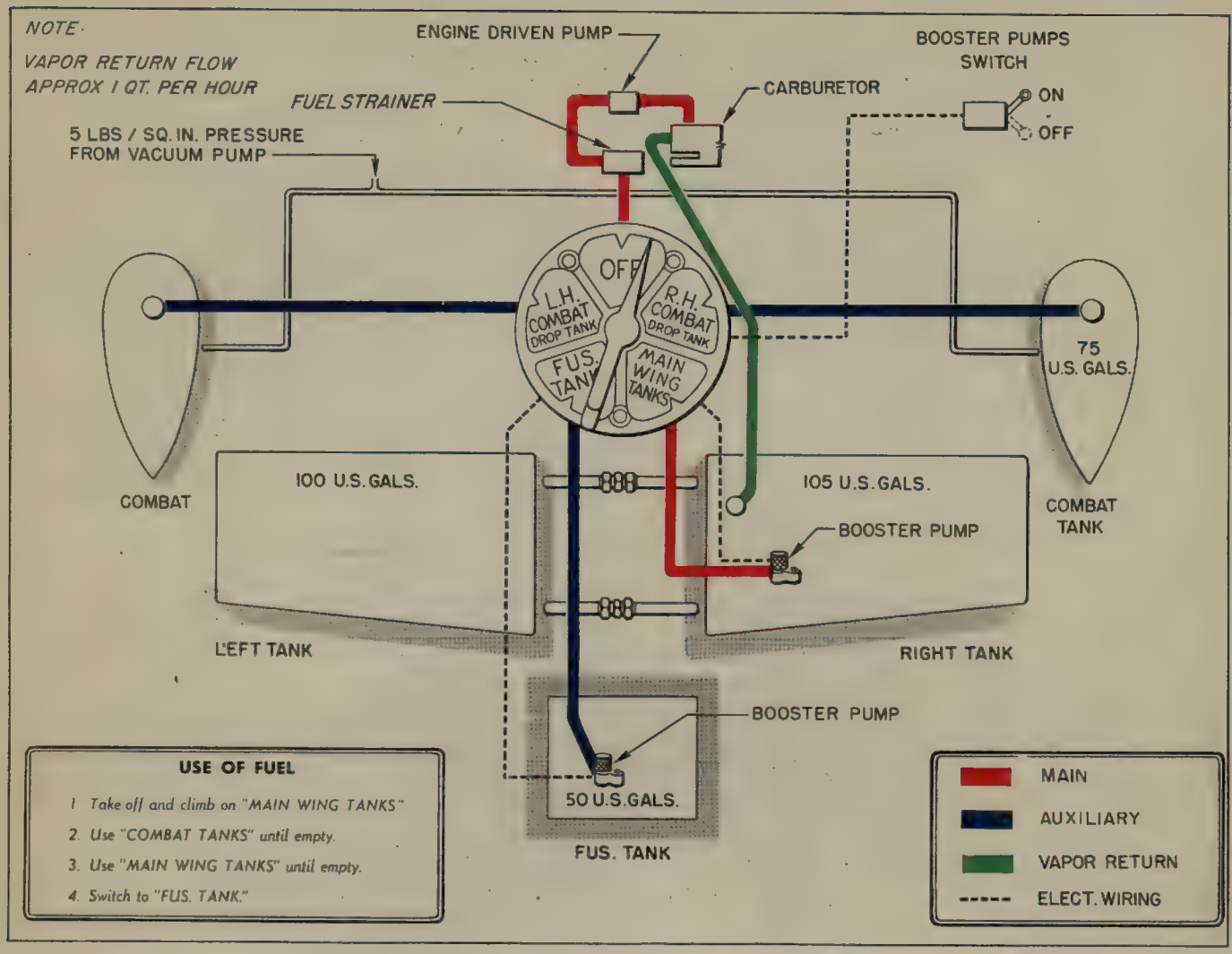


Figure 7—Fuel System Line Diagram

n. Turn ignition switch to "BOTH."

o. Prime two seconds when cold, one second when hot.

CAUTION

Do not prime until engine is being turned by starter.

p. As engine starts, move mixture control to "RUN." If engine does not start after several turns, continue priming.

CAUTION

When engine is not firing, mixture control should be in "IDLE CUT OFF."

q. Check oil pressure. If pressure is not up to 50 pounds within 30 seconds, stop engine and investigate.

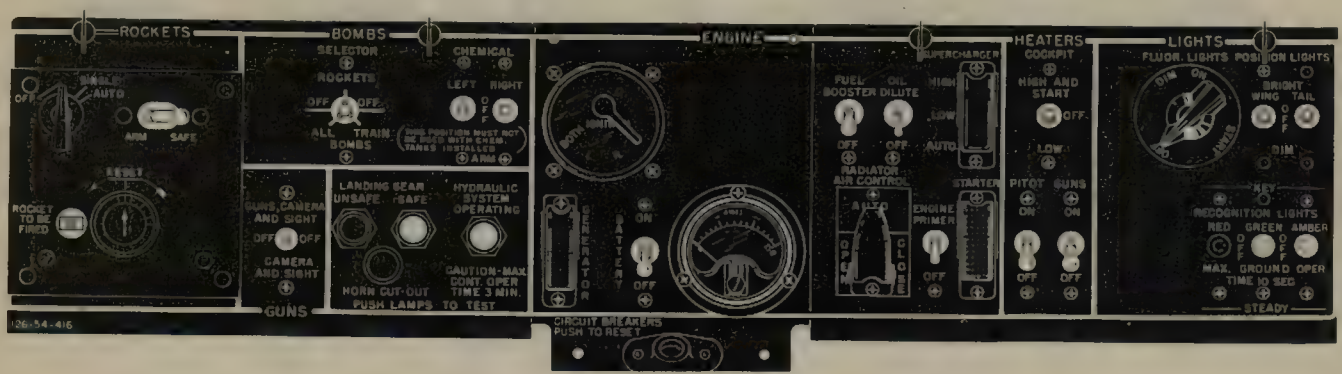


Figure 8—Front Switch Panel

5. WARM-UP AND GROUND TEST.

a. Warm up engine at 1300 rpm until oil temperature shows a definite increase and oil pressure remains steady when throttle is opened. Desired oil and coolant temperatures will be maintained by leaving coolant radiator air control in "AUTOMATIC." If coolant and oil temperatures exceed limits with controls in "AUTOMATIC," shut off engine and investigate.

b. With manifold pressure less than 25 in. Hg, depress manifold pressure drain for 3 seconds.

c. Keep flight indicator uncaged at all times, except during maneuvers which exceed operating limits.

Note

If horizon bar on flight indicator is not level after engine is started, cage gyro momentarily.

d. After engine has warmed sufficiently, proceed with these tests:

(1) Check main and fuselage fuel systems by rotating fuel selector with booster pump switch on. Check fuel pressure: 16 pounds per square inch minimum, 19 pounds per square inch maximum. If droppable tanks are installed, check fuel flow from them by rotating fuel selector.

(2) Check operation of wing flaps.

(3) Check operation of radiator air outlet flap (with assistance of outside observer) using "OPEN" and "CLOSED" positions of radiator air control switch. Return switch to "AUTOMATIC."

(4) Check communication equipment for proper operation.

(5) At 2300 rpm, check the following:

Suction	3.75-4.25 in. Hg
Ammeter	100 amperes maximum

(6) Check all engine instruments in desired range. *(Refer to Power Plant Charts, section III.)*

(7) With propeller control in full "INCREASE RPM," set throttle control to obtain 2300 rpm. Move propeller control back to note maximum drop of 300 rpm, and then move forward to full "INCREASE RPM."

Note

Watch manifold pressure during propeller check. If regulator is performing properly, manifold pressure should remain constant within one in. Hg.

(8) At 2300 rpm, with propeller in full "INCREASE RPM", check each magneto. A maximum drop of 100 rpm is allowed for the right magneto and 130 rpm drop allowed for the left magneto.

(9) Check supercharger operation: With propeller control at full "INCREASE RPM" and engine speed at 2300 rpm, hold supercharger switch in "HIGH." Rpm drop should be at least 50 rpm.

(10) Have ground personnel release tail, remove wheel chocks, and disconnect external power supply.

(11) Turn "ON" battery-disconnect switch if it was "OFF" (while using external power supply).

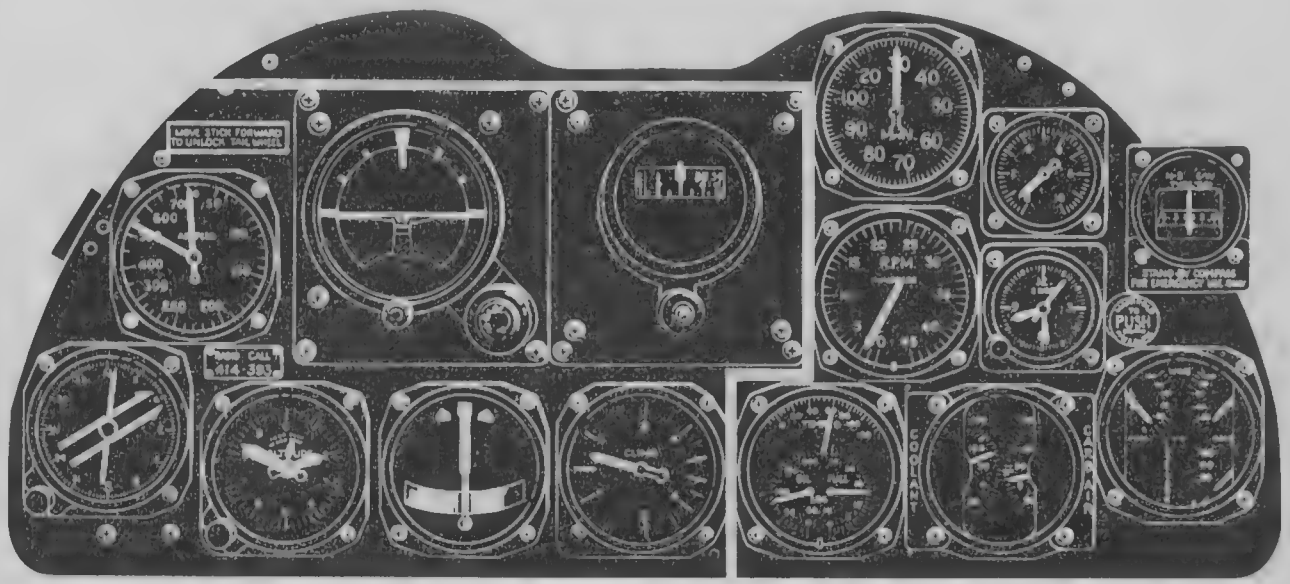


Figure 9—Instrument Panel

(9) Check supercharger operation: With propeller control at full "INCREASE RPM" and engine speed at 2300 rpm, hold supercharger switch in "HIGH." Rpm drop should be at least 50 rpm.

(10) Have ground personnel release tail, remove wheel chocks, and disconnect external power supply.

(11) Turn "ON" battery-disconnect switch if it was "OFF" (while using external power supply).

6. SCRAMBLE TAKE-OFF.

Use oil dilution (3 minutes maximum) to obtain proper oil pressure at moderate power, and as soon as engine will take throttle, taxi out, and take off.

Note

Overdilution is likely to result under these conditions because of low oil flow and a cold engine which hold back evaporation. If dilution is used, observe oil pressure closely during time of dilution and take-off to determine whether or not oil has been overdiluted. Overdilution will cause low oil pressure, and loss of oil through engine breathers.

7. TAXIING INSTRUCTIONS.

a. Raise wing flaps to prevent their being damaged.

CAUTION

Taxi cautiously to avoid damage from objects which tires might pick up and throw against radiator air outlet flap.

b. Steer a zigzag course to obtain an unobstructed view.

c. Taxi with stick slightly aft of neutral to lock tail wheel. In locked position, tail wheel may be turned 6 degrees to right or left with rudder pedals. For sharp turns, push stick forward of neutral position to allow full-swiveling action of tail wheel.

d. Use brakes as little as possible.

e. Upon reaching take-off position, stop airplane at right angles to runway so that approaching airplanes may be plainly seen.

f. If it is necessary to wait long at take-off position, recheck magnetos.

8. TAKE-OFF.

a. Set rudder trim 7 degrees to the right; elevator trim 2 degrees nose heavy; aileron trim 0 degrees.

b. Check flying controls for free movement (look at control surfaces).

c. Check fuel levels.

d. See that fuel selector is set on "MAIN WING TANKS" and that booster pump switch is on (pressure 16 to 18 psi).

e. Generator-disconnect and battery-disconnect switches "ON."

f. Mixture control "RUN."

g. Propeller control full "INCREASE RPM."

h. Supercharger blower switch "AUTO."

i. Coolant radiator air control "AUTOMATIC."

j. Carburetor air control "RAMMED" ("FILTERED" or "HOT AIR," if required).

k. See that cockpit enclosure is locked and that emergency release handle is safetied.

l. Make sure take-off area is clear.

m. Wing flaps 15 to 20 degrees down for best obstacle clearance.

n. Oil pressure 60 psi minimum.

o. Oil temperature 20°C minimum, 105°C maximum.

p. Coolant temperature 60°C minimum, 125°C maximum.

q. Open throttle to gate—61 in. Hg at 3000 rpm (5 minutes maximum)—and take off.

Note

Do not attempt to lift tail too soon, as this increases torque action. Pushing stick forward unlocks tail wheel, thereby making steering difficult. Best take-off procedure is to hold tail down until sufficient speed is attained, and then raise tail slowly.

9. ENGINE FAILURE DURING TAKE-OFF.

a. The chances of engine failure during take-off can be greatly reduced if the engine is run up carefully and checked thoroughly beforehand.

b. The hazards due to engine failure during take-off can be minimized by observing the following practices:

(1) Retract landing gear as soon as airplane is definitely airborne. Return control lever to "NEUTRAL" after red warning light goes off and hydraulic pressure amber indicator illuminates.

(2) If flaps are used for take-off, raise as soon as airplane reaches a safe altitude.

Note

The wing flaps cannot be operated unless the landing gear control lever is in "NEUTRAL."

c. If engine fails immediately after take-off, act quickly as follows:

(1) Depress nose at once so that airspeed does not drop below stalling speed.

(2) If external fuel tanks or bombs are installed, release them immediately.

(3) Release sliding canopy by pulling the emergency release handle on top of longeron, at the right of instrument panel.

WARNING

Before emergency release of canopy in flight, drop seat and lower head as far as possible.

(4) When a reasonable doubt exists as to the condition of the terrain on which you are being forced to land, or if

there is a probability of the airplane nosing over or overrunning the available landing area, retract the landing gear.

(5) Lower flaps fully, if possible.

(6) Move mixture control to "IDLE CUT OFF," and turn ignition switch "OFF."

(7) Turn "OFF" fuel selector.

(8) Turn "OFF" battery-disconnect switch.

(9) Land straight ahead, only changing directions sufficiently to miss obstructions.

(10) After landing, leave airplane as quickly as possible, and remain outside.

10. CLIMB.

a. As soon as airplane is sufficiently clear of ground, proceed as follows:

(1) Pull landing gear control handle to the "UP" position to retract gear. Check position of gear by indicator lights on front switch panel. Return handle to "NEUTRAL" after red warning light goes off and hydraulic pressure amber indicator illuminates.

(2) Raise flaps by pulling flap control to full up position when sufficient airspeed is attained and all obstacles are cleared.

(3) Check coolant and oil temperatures, and oil pressure.

Note

As rate of climb can vary widely (depending on weigh carried, external loading, and altitude), refer to Take-off, Climb, and Landing Chart for rate of climb applicable to the particular mission to be conducted.

11. GENERAL FLYING CHARACTERISTICS.

The flying qualities of the airplane are normal, both in accelerated maneuvers and in steady flight. The trim tab characteristics are normal, but sensitive for high-speed trim conditions.

The stick forces in pull-outs and turns increase with load factor and do not lighten or reverse. *(For exception, refer to paragraph 17 of this section.)* At all speeds with power, sideslips to the left require less pedal force than do sideslips to the right, but the force variation is normal. Moderate fin buffeting occurs at high angles of sideslip.

Landing gear extended—airplane becomes *nose* heavy.

Flaps lowered—airplane becomes *tail* heavy.

Landing gear extended and flaps lowered—airplane becomes *tail* heavy.

12. DURING FLIGHT.

a. GENERAL.

(1) Set throttle and propeller controls to desired manifold pressure and rpm.

(2) Periodically check for these desired instrument readings *(figure 10):*

Oil pressure	70-80 psi desired, 50 psi minimum
Oil temperature	70°- 80°C desired, 20°C minimum, 105°C maximum
Coolant temperature	100°-110°C desired, 60°C minimum, 125°C maximum
War Emergency	135°C maximum
Fuel pressure	16-18 psi desired, 14 psi minimum, 19 psi maximum

Note

With radiator air control set in "AUTOMATIC," coolant temperature will be approximately 100°-110°C. It should be noted that with very high powers on hot days, even though radiator air control is in "AUTOMATIC," these temperature limits may be exceeded because the outlet flap is in full open position, making it impossible for the automatic control to maintain desired temperature limits.

(3) For engine operation, see Power Plant Chart, section III, and Flight Operation Instruction Charts, appendix I.

CAUTION

Do not use carburetor heat at altitudes above 12,000 feet. This precaution is necessary because heat has an adverse (leaning) effect on the carburetor altitude compensator mechanism above this altitude.

13. WAR EMERGENCY OPERATION.

a. GENERAL.

(1) War Emergency Ratings have been established to make available in combat the absolute maximum manifold pressure at which the engine may be operated, within reasonable safety limits, for a 5-minute period under emergency conditions.

(2) This rating is considerably higher than ratings given in the engine specification under which the engine was delivered, particularly with water injection. Since its use will decrease the engine's normal service life and time between overhauls, War Emergency Ratings should be held for use *only when emergency conditions exist.* War Emergency Ratings are not guaranteed power ratings, but are maximum manifold pressure ratings as established by correct settings of the automatic manifold pressure regulator and the correct setting of the propeller governor to allow the propeller to turn at 3000 rpm.

(3) Use of War Emergency Ratings is permissible only when the following requirements are fulfilled:

(a) Airplane must be in combat or precombat areas, as designated by the AAF.

(b) KLG RC5/3, Lodge RS5/5, AC LE-44, or AC LE-45 spark plugs must be installed.

(c) A break-through seal must be installed on the throttle quadrant to inform the crew chief that the engine has been operated at war emergency power.

117-42090C ENGINE LIMITATIONS PACKARD V-1650-9

FUEL SPECIFICATION: AN-F-28

	RPM	MP
TAKE-OFF 5 MIN. MAX.	3000	61
WAR EMERG. 5 MIN. DRY	3000	67
WAR EMERG. WET	3000	80
MILITARY 15 MIN. MAX.	3000	61
MAX. CONTINUOUS	2700	46
CRUISE - MAX.	2400	42

	MAX.	DESIRED
COOLANT	125	100-110
COOLANT (WAR EMERG.)	135	
OIL TEMP.	105	70-80
OIL PRESSURE		70-80
OIL PRESSURE MIN. CR.	50	
FUEL PRESSURE	19	16-18
MAX. ENGINE OVERSPEED	3240 RPM	

TAKE-OFF CONDITIONS

OIL TEMP. 20° C MIN., OIL PRESS. 60 MIN., COOLANT 60° C MINIMUM

Figure 10—Engine Limitations

Note

For war emergency operation with water injection, spark plug barrels and spark plug cable connectors must be packed with Dow-Corning sealing compound No. 4, and a steel or brass washer must be inserted between the resistor and the spring retainer of the spark plug cable connector.

(c) A break-through seal must be installed on the throttle quadrant to inform the crew chief that the engine has been operated at war emergency power.

Note

Entry shall be made on Form 1A of time of war emergency operation for close coordination with ground engineering.

(d) Airplane must be placarded with a decal stating that use of War Emergency Ratings is permitted.

b. OPERATION.—If it is necessary to use war emergency power, proceed as follows:

CAUTION

If the oil has been diluted, it is desirable to operate the engine 10 or 15 minutes at from 80 percent normal to military power before using War Emergency Ratings.

(1) Mixture control in "RUN."

(2) Move water injection switch to "ON" for War Emergency Wet operation.

(3) Move propeller control to full "INCREASE RPM."

(4) Advance throttle to obtain manifold pressure desired.

(5) Use war emergency power for 5 minutes dry (7 minutes wet) maximum. Do not permit coolant temperature to exceed 135° C. Oil temperature must not exceed 105° C.

WARNING

The following precaution is applicable to War Emergency Wet operation of airplanes, Serial Nos. AAF44-64688 through 64712 only. After the water supply is exhausted, as indicated by automatic resetting of manifold pressure to the maximum dry rating, move the water injection switch to "OFF." If the switch is left "ON" and the throttle retarded and again advanced, a time delay relay in the circuit to the water pump will start the pump (even after the water supply has been expended) and momentarily increase manifold pressure above the allowable dry limit with possible damage to the power plant when no water is available.

14. STALLS.

The stall in this airplane is comparatively gentle. With idling power, stall warning is given by very slight airplane buffeting 2 to 3 mph above stall speed, followed by nose-down pitching at stall. There is mild longitudinal oscillation until the stick pressure is relieved. If further back pressure is applied, the airplane will roll off on either right or left wing. This rolling condition is more severe with flaps down. Recovery from the stall is entirely normal and is accomplished by releasing back pressure on the stick. In approaching the stall, some aileron deflection may be required to hold wings level. The high-speed stall is characterized by some buffeting, but no abrupt rolling is experienced.

The stalling speed can vary widely with gross weight and external loads.

STALLING SPEEDS

With or Without Wing Racks (no external load)

Gear and Flaps Up			
Gross Weight	9500	8500	7500
IAS (mph)	114	108	101
Gear and Flaps Down			
Gross Weight	9500	8500	7500
IAS (mph)	103	96	89

With External Load

Information to be furnished when available.

15. SPINS.

a. POWER-OFF SPINS.

(1) DESCRIPTION.

(a) The airplane does not have any spin tendency at the stall, and it is necessary to force the airplane into the spin.

(b) In general, spins in this airplane are uncomfortable because of heavy oscillations and rolling. These motions are not regular, but occur erratically during the spin. Normally, the airplane goes over to a slightly inverted position in the first half turn of the spin.

(c) Spins to the left with gear and flaps up are fairly slow and approach a nearly stabilized condition after approximately three turns. The airplane spins to the left at an angle of approximately 45 degrees below the horizontal. The rate of spin rapidly increases as control is applied for recovery.

(d) The right spin with gear and flaps up is erratic with the nose of the airplane coming up to the horizontal and then dropping with a sudden lateral oscillation accompanied by a very rapid increase in rate of spin. During the spin it feels as though the airplane is partially recovering before it whips off again. Although the spin does not stabilize, the recovery characteristics are excellent. The spin is always more rapid and erratic to the right than to the left.

(e) With the gear extended the spin is erratic both to the left and right with the same lateral and longitudinal oscillations noted with the gear retracted in *right spins.* During recovery from the right spin (gear extended) a slight buffet may be noted; this buffet is eliminated as soon as the airspeed is increased.

(2) RECOVERY.—Recovery is made by applying rudder against the spin and returning the stick to neutral. The rudder and elevator forces are normal with no excessive loads during recovery. Recovery from spins may be effected within one-fourth to one turn. Approximately 6500-7000 feet altitude is lost during a five-turn spin plus a one-turn recovery.

b. POWER-ON SPINS.

(1) Power-on spins are not recommended.

(2) Power-on spin characteristics have not been checked in flight tests; however, if a power-on spin is encountered inadvertently, close throttle completely and apply control for recovery. Large losses in altitude should be anticipated if power-on spins and recoveries are attempted.

16. PERMISSIBLE ACROBATICS.

All acrobatics are permitted, with the exception of snap rolls and power-on spins. Inverted flying must be limited to 10 seconds because of loss of oil pressure and failure of scavenge pumps to operate in an inverted position.

17. DIVING.

a. MAXIMUM DIVING SPEEDS.—At high diving speeds there is danger of the airplane being affected by compressibility—a phenomenon likely to be encountered when the true airspeed approaches the speed of sound. Compressibility may be indicated by instability of the airplane, rolling or pitching, lightening or reversing of control forces, or combinations of these effects.

However, the P-51H Airplane feels steady up to the limit Mach number of present tests, .75 (75 percent speed of sound), and no porpoising or wallowing has been experienced. Some buffeting may be expected above a Mach number of .75, and increased aileron control pressure may be necessary to hold wings level.

Attention should be paid to the elevator stick force variation during high-speed dives. In high-speed dives at high altitudes, with the airplane trimmed in level flight at normal rated power, it will be noted that stick forces increase during the first part of the dive, then lighten as the speed is increased, and finally may reverse, requiring slight pull force. The above elevator force variation is a compressibility effect, with forces first lightening at a Mach number of .72 and possibly reversing at some higher Mach

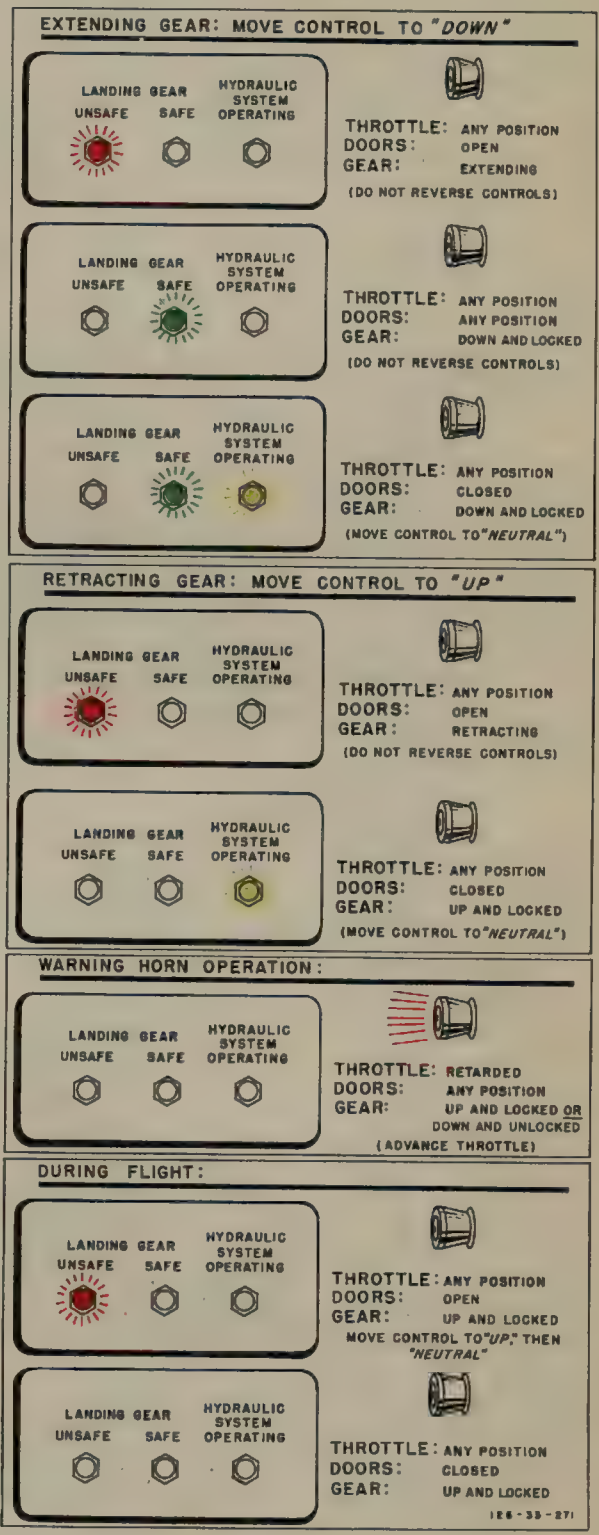


Figure 11—Landing Gear Position Indicators

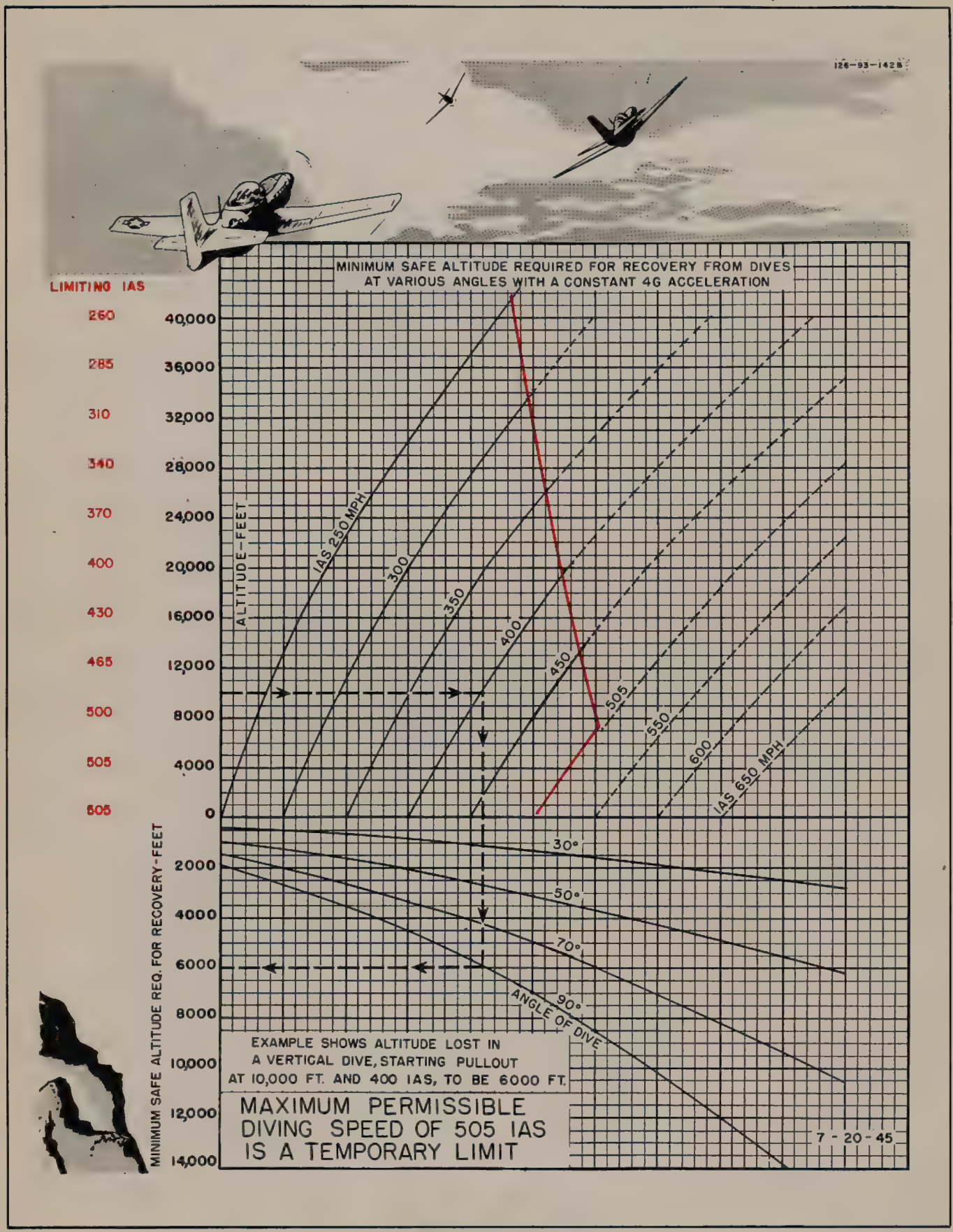


Figure 12—Diving Limitations

b. ALTITUDE REQUIRED FOR PULL-OUT.—Figure 12 shows the minimum safe altitude required for a pull-out from dives, with a constant 4-G acceleration.

c. RECOVERY.—If, through necessity or inadvertence, the diving limits shown on figure 12 are exceeded and pronounced compressibility effects are experienced, pull up very gradually.

WARNING

Care should be taken in pull-outs, since the stick forces are relatively light, and abrupt pull-outs should be avoided.

18. NIGHT FLYING.

Note

Spare bulbs are contained in the small compartment on the right forward side of the cockpit.

In flying at night, the sequence outlined for daylight operation should be even more strictly observed. In addition, familiarize yourself with the location of the different lights and their control switches, especially the landing light switch which is on the left side of the cockpit just above the aileron tab control.

a. INSTRUMENT LIGHTING.—Turn on fluorescent lamp by turning rheostat knob on front switch panel to "START" until light comes on; then switch to either "ON" or "DIM" position. Rotating the lens housing selects visible or invisible illumination.

b. POSITION LIGHTS.—The position light switches are on front switch panel. Two intensities of light are available: "BRIGHT" and "DIM."

c. LANDING LIGHT.—The landing light switch is on left side of cockpit above aileron trim tab control.

d. A Type C-5 fluorescent light is on the right side of the cockpit, and its rheostat control is on the right switch panel. A Type C-4 cockpit spotlight is stowed under the gun sight and can be used in this position or may be placed in a mount under the right side of the shroud. Spare lamps are in a panel on the right side of the cockpit beneath the upper longeron.

e. RECOGNITION LIGHTS.—Set switches, located on front switch panel, for light or combination of lights desired. Turn switches to "STEADY" for continuous operation, or to "KEY" for intermittent operation.

19. APPROACH AND LANDING.

a. APPROACH.—When approaching landing area, follow this sequence:

(1) Mixture control "RUN."

(2) Coolant radiator air control "AUTOMATIC."

(3) Fuel selector to internal tank with most fuel. Booster pump switch on.

(4) Propeller control set for 2700 rpm.

(5) Lower the landing gear below 170 IAS. Check operation and position of gear by indicator lights on front switch panel and return control lever to "NEUTRAL" after red warning light goes off and hydraulic pressure amber indicator illuminates.

CAUTION

Since the position of the tail wheel is not indicated by the warning lights, do not return the control lever to "NEUTRAL" until the amber light illuminates showing that the hydraulic system is fully pressurized and providing additional assurance that the tail wheel is down and locked.

WARNING

Do not reverse the movement of the landing gear control lever after starting it toward the "UP" or "DOWN" position. Always move it to the full "UP" or "DOWN" position and leave there until the gear is locked in position and the fairing doors are closed. Reversing the movement will interrupt the operating sequence and may result in the door interfering with the gear. A period of from 10 to 15 seconds is required for the gear to completely extend and lock and the fairing doors to close before the control lever may be moved to the "NEUTRAL" position.

(6) If desired, lower flaps 15 degrees to give a steeper approach angle. When the airplane has been brought into the wind for landing, lower flaps fully at an altitude not less than 400 feet with airspeed below 160 IAS.

b. LANDING.

(1) GENERAL.—After turning into the field and lowering flaps, maintain a correct gliding speed (recommended gliding speed is 130 IAS). Adjust elevator trim tab to assist in landing. Having stopped after landing, raise flaps before taxiing.

(2) CROSS-WIND LANDING.—As the airplane has a landing gear of wide tread and a steerable tail wheel, cross-wind landings may be negotiated safely. Keep one wing down into the wind, to counteract drift.

(3) MINIMUM RUN LANDING.

(a) For a minimum run landing over an obstacle, lower flaps fully and reduce power completely.

(b) For a minimum run landing with no obstacle, use full flaps and make a flat, power-on approach.

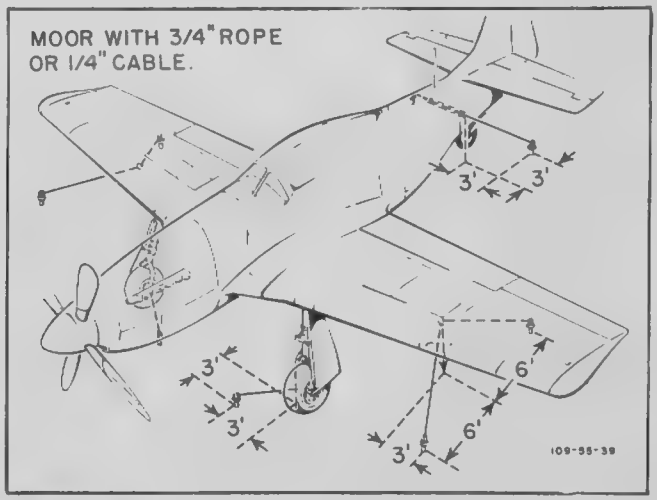


Figure 13—Mooring Airplane

(4) GO-AROUND PROCEDURE.—If an attempt to land is unsuccessful:

(a) Open throttle.

(b) Push propeller control to full "INCREASE RPM."

(c) Raise landing gear. When gear is fully retracted, move landing gear control lever to "NEUTRAL" to permit operation of wing flaps.

(d) When airspeed reaches 100 IAS, raise flaps.

20. STOPPING ENGINE.

a. Turn "OFF" booster pump switch.

b. If a cold weather start is anticipated, hold oil dilution switch "ON" (2 minutes maximum).

c. Run engine to 1500 rpm, set mixture control in "IDLE CUT OFF," and move throttle to gate. Leave mixture control in "IDLE CUT OFF" as a precaution against accidental starting.

d. Turn all switches "OFF" after engine ceases firing.

e. Turn "OFF" fuel selector control.

21. BEFORE LEAVING COCKPIT.

a. Make sure all switches are "OFF."

b. Set parking brakes.

c. Turn carburetor air control to "FILTERED" position.

d. Close canopy after leaving cockpit.

22. MOORING.

a. Head airplane into wind.

b. Set parking brakes.

c. Engage surface control lock.

d. Moor airplane as shown in figure 13.

e. Install engine and cockpit covers.

Section III

OPERATING DATA

1. AIRSPEED CORRECTION TABLES.

a. Two corrections must be made on the IAS in order to obtain the true indicated airspeed. The first correction is for the pitot installation; the second is for compressibility effects. Use the Airspeed Installation Correction Table to find the corrected indicated airspeed; then use the Compressibility Correction Table to obtain the true indicated airspeed.

b. EXAMPLE.

(1) PROBLEM.—Find true indicated airspeed from an IAS of 400 at 25,000 feet.

(2) ANSWER.—Corrected IAS = 400 + 4 (position error), or 404. True indicated airspeed = 404 less 19 or 385.

AIRSPEED INSTALLATION CORRECTION TABLE
(With or Without External Load)

IAS (mph)	CORRECTION
FLAPS UP	
100	Add 5 mph
150	Add 4 mph
200	Add 3 mph
250	Add 2 mph
300	Add 2 mph
350	Add 3 mph
400	Add 4 mph
FLAPS FULL DOWN	
90	Add 3 mph
100	Add 1 mph
110	Subtract 1 mph
120	Subtract 2 mph
130	Subtract 3 mph

WAR EMERGENCY (WET) (Combat Emergency)			OPERATING CONDITION		
Limited By Water Supply Available—Approximately 7 minutes			Time Limit		
Run 3,000			Mixture R.P.M.		
Manif. Press.	Supercharger	(2) Fuel Gal/Min	Std. Temp. °C	Pressure Altitude	Std. Temp. °F
F.T.	High	2.5	—55.0	40,000 ft.	—67.0
F.T.	High	2.5	—55.0	38,000 ft.	—67.0
F.T.	High	3.0	—55.0	36,000 ft.	—67.0
F.T.	High	3.0	—52.4	34,000 ft.	—62.3
F.T.	High	3.0	—48.4	32,000 ft.	—55.1
F.T.	High	3.5	—44.4	30,000 ft.	—48.0
80	High	3.5	—40.5	28,000 ft.	—40.9
80	High	3.5	—36.5	26,000 ft.	—33.7
80	High	3.5	—32.5	24,000 ft.	—26.5
80	High	3.5	—28.6	22,000 ft.	—19.4
F.T.	Low	3.0	—24.6	20,000 ft.	—12.3
F.T.	Low	3.0	—20.7	18,000 ft.	— 5.2
F.T.	Low	3.5	—16.7	16,000 ft.	2.0
F.T.	Low	3.5	—12.7	14,000 ft.	9.1
80	Low	3.5	— 8.8	12,000 ft.	16.2
80	Low	3.5	— 4.8	10,000 ft.	23.4
80	Low	3.5	— 0.8	8,000 ft.	30.5
80	Low	3.5	3.1	6,000 ft.	37.6
80	Low	3.5	7.1	4,000 ft.	44.7
80	Low	3.5	11.0	2,000 ft.	51.8
80	Low	3.5	15.0	Sea Level	59.0

(2) *Gal/Min:* Approximate U.S. Gallon per Minute per Engine.
Data as of 11-20-44 based on Estimated Performance.

Figure 14—Power Plant Chart (War Emergency Wet)

COMPRESSIBILITY CORRECTION TABLE

Subtract From Corrected Indicated Airspeed

Pressure Altitude	CORRECTED IAS (mph)							
	150	200	250	300	350	400	450	500
10,000	0	1	2	3	4	6	8	10
15,000	0	1	3	4	7	10	13	17
20,000	1	2	4	6	10	14	19	25
25,000	1	3	5	9	13	19	26	33
30,000	2	4	7	12	19	25	33	42
35,000	2	5	10	16	25	33	42	53

POWER PLANT CHART

AIRCRAFT MODEL(S)	PROPELLER(S)	ENGINE MODEL(S)
P-51H	AEROPRODUCTS CONSTANT-SPEED	V-1650-9

GAUGE READING	FUEL PRESS.	OIL PRESS.	OIL TEMP.	COOLANT TEMP.	CARB. AIR TEMP.
DESIRED MAXIMUM	16-18 19	70-80	70-80 105	100-110 125(3)	15-30 40
MINIMUM IDLING	14 9	50 15			

MAXIMUM PERMISSABLE DIVING RPM: 3240
MINIMUM RECOMMENDED CRUISE RPM: 1600

OIL GRADE: 1120
FUEL GRADE: 100/130, SPEC. NO. AN-F-28
COOLANT: SPEC. NO. AN-E-2 WITH NaMBT

WAR EMERGENCY (DRY)			MILITARY POWER (NON-COMBAT EMERGENCY)			OPERATING CONDITION			NORMAL RATED (MAXIMUM CONTINUOUS)			MAXIMUM CRUISE (NORMAL OPERATION)		
5 MINUTES			15 MINUTES			TIME LIMIT			UNLIMITED			UNLIMITED		
RUN 3000			RUN 3000			MIXTURE R. P. M.			RUN 2700			RUN 2400		
MANIF. PRESS.	SUPER-CHARGER	FUEL(1) Gal/Min	MANIF. PRESS.	SUPER-CHARGER	FUEL(1) Gal/Min	STD. TEMP. °C	PRESSURE ALTITUDE	STD. TEMP. °F	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH(2)	MANIF. PRESS.	SUPER-CHARGER	FUEL GPH(2)
F.T.	HIGH	2.0	F.T.	HIGH	2.0	-55.0	40,000 FT.	-67.0	F.T.	HIGH	75	F.T.	HIGH	54
F.T.	HIGH	2.0	F.T.	HIGH	2.0	-55.0	38,000 FT.	-67.0	F.T.	HIGH	84	F.T.	HIGH	58
F.T.	HIGH	2.5	F.T.	HIGH	2.5	-55.0	36,000 FT.	-67.0	F.T.	HIGH	95	F.T.	HIGH	63
F.T.	HIGH	3.0	61	HIGH	3.0	-52.4	34,000 FT.	-62.3	46	HIGH	97	F.T.	HIGH	68
67	HIGH	3.5	61	HIGH	3.0	-48.4	32,000 FT.	-55.1	46	HIGH	96	F.T.	HIGH	74
67	HIGH	3.5	61	HIGH	3.0	-44.4	30,000 FT.	-48.0	46	HIGH	94	42	HIGH	80
67	HIGH	3.5	61	HIGH	3.0	-40.5	28,000 FT.	-40.9	46	HIGH	93	42	HIGH	79
67	HIGH	3.5	F.T.	LOW	3.0	-36.5	26,000 FT.	-33.7	F.T.	LOW	108	F.T.	LOW	70
F.T.	LOW	3.0	F.T.	LOW	3.0	-32.5	24,000 FT.	-26.5	F.T.	LOW	115	F.T.	LOW	75
F.T.	LOW	3.0	F.T.	LOW	3.0	-28.6	22,000 FT.	-19.4	F.T.	LOW	122	F.T.	LOW	80
F.T.	LOW	3.5	61	LOW	3.5	-24.6	20,000 FT.	-12.3	46	LOW	125	F.T.	LOW	86
67	LOW	3.5	61	LOW	3.5	-20.7	18,000 FT.	- 5.2	46	LOW	120	F.T.	LOW	92
67	LOW	3.5	61	LOW	3.0	-16.7	16,000 FT.	2.0	46	LOW	115	42	LOW	95
67	LOW	3.5	61	LOW	3.0	-12.7	14,000 FT.	9.1	46	LOW	110	42	LOW	91
67	LOW	3.5	61	LOW	3.0	- 8.8	12,000 FT.	16.2	46	LOW	105	42	LOW	88
67	LOW	3.5	61	LOW	3.0	- 4.8	10,000 FT.	23.4	46	LOW	100	42	LOW	85
67	LOW	3.5	61	LOW	3.0	- 0.8	8,000 FT.	30.5	46	LOW	98	42	LOW	83
67	LOW	3.5	61	LOW	3.0	3.1	6,000 FT.	37.6	46	LOW	95	42	LOW	81
67	LOW	3.0	61	LOW	3.0	7.1	4,000 FT.	44.7	46	LOW	92	42	LOW	79
67	LOW	3.0	61	LOW	3.0	11.0	2,000 FT.	51.8	46	LOW	89	42	LOW	76
67	LOW	3.0	61	LOW	3.0	15.0	SEA LEVEL	59.0	46	LOW	86	42	LOW	73

GENERAL NOTES

(1) *Gal/Min:* APPROXIMATE U.S. GALLON PER *MINUTE* PER ENGINE
(2) GPH: APPROXIMATE U.S. GALLON PER HOUR PER ENGINE.
(3) COOLANT TEMP. 135°C FOR WAR EMERGENCY ONLY
F.T.: MEANS FULL THROTTLE OPERATION.
VALUES ARE FOR LEVEL FLIGHT WITH RAM.

FOR COMPLETE CRUISING DATA SEE APPENDIX II
NOTE: TO DETERMINE CONSUMPTION IN BRITISH IMPERIAL UNITS, MULTIPLY BY 10 THEN DIVIDE BY 12. RED FIGURES ARE PRELIMINARY SUBJECT TO REVISION AFTER FLIGHT CHECK.

TAKE-OFF CONDITIONS:
3000 RPM 61" HG

*CONDITIONS TO AVOID:
LOW BLOWER: OPERATION BELOW 1600 RPM
HIGH BLOWER: OPERATION BELOW 2000 RPM

SPECIAL NOTES

REFER TO FIGURE 13A FOR *WAR EMERGENCY (WET)*

*AVOID OPERATION BELOW 1600 RPM IN LOW BLOWER AS GENERATOR WILL NOT DELIVER SUFFICIENT AMPERAGE.
*AVOID OPERATION BELOW 2000 RPM IN HIGH BLOWER BECAUSE OF ENGINE ROUGHNESS.

DATA AS OF *11/20/44* BASED ON *ESTIMATED PERFORMANCE*

AAFMC-526
4-1-45

Figure 15—Power Plant Chart

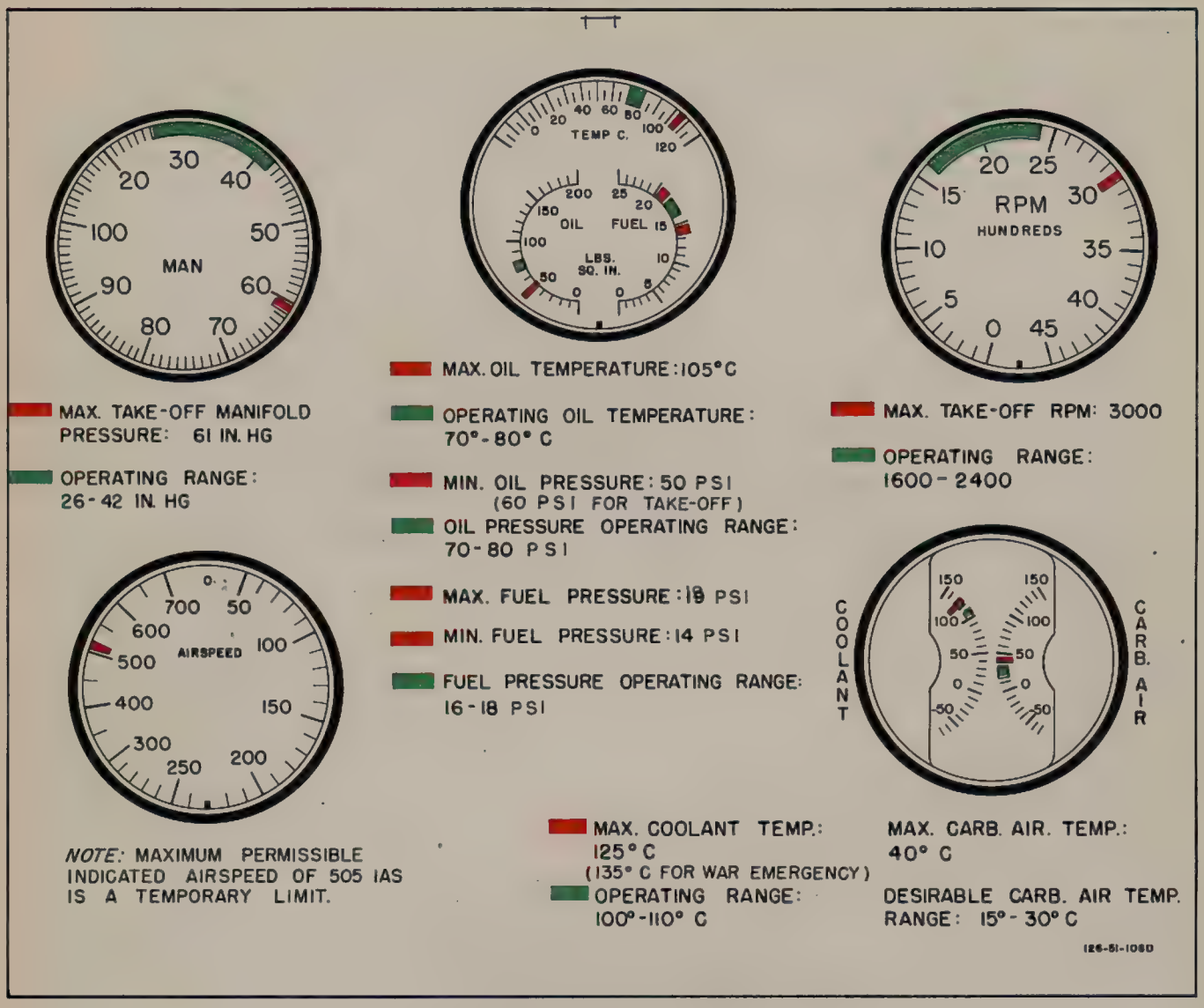


Figure 16—Instrument Limitations

Section IV

EMERGENCY OPERATING INSTRUCTIONS

1. EMERGENCY EXIT DURING FLIGHT.

a. If an emergency exit must be made during flight, the following procedures are recommended:

(1) Release sliding canopy by pulling emergency release handle on right longeron. Unfasten safety belt and shoulder harness, and disconnect headphones and oxygen tube; then roll airplane over on its back and drop out.

WARNING

Before emergency release of canopy in flight, drop seat and lower head as far as possible.

(2) Release sliding canopy, and unfasten safety belt and shoulder harness; then:

(a) Raise seat to topmost position.

(b) If possible, reduce speed and trim airplane to fly "hands off."

(c) Disconnect headphones and oxygen tube.

Note

If jump is made at high altitude, turn the control on the oxygen regulator to 100 percent oxygen, and inhale as much oxygen as possible before jumping.

(d) Rise to a crouched position in seat, placing right foot on seat and left foot against left longeron. Grasp right longeron with right hand and right side of windshield with left hand. *(See figure 17.)*

(e) Kick with legs and push with hands at instant of leaving cockpit, and dive for the right wing tip.

Note

The right side is recommended because the slipstream will help you clear the airplane. If this method is used, the wing will either pass your body, or it will be possible to slide off the wing without striking the empennage.

2. ENGINE FAILURE DURING FLIGHT.

a. If the engine fails during flight, the airplane may be abandoned, ditched *(paragraph 7)*, or brought in for a dead-stick landing. For a landing with the engine dead, follow these instructions:

Figure 17—Emergency Exit During Flight

Figure 18—Ditching Airplane

(1) Depress the nose at once so that the airspeed does not drop below stalling speed.

(2) If external tanks or bombs are installed, release them immediately. *(See paragraph 4 in this section.)*

(3) Turn "OFF" fuel selector control, ignition switch, and battery-disconnect switch.

(4) Choose an area for landing. If near a landing field, notify tower. Judge your turns carefully and plan to land into the wind.

(5) Release sliding canopy by pulling emergency release handle on right longeron.

WARNING

Before emergency release of canopy in flight, drop seat and lower head as far as possible.

(6) If a long runway is available, and if there is sufficient time and altitude to properly plan an approach, lower the landing gear. If landing under any other condition, keep the gear up; you will stand less chance of injury by making a belly landing.

(7) Lower the flaps approximately 30 degrees, saving the last 20 degrees of flap to overcome possible mistakes in judgment. Lower flaps fully when proper landing is assured.

Note

The wing flaps cannot be lowered unless the landing gear control lever is in "NEUTRAL."

(8) Land into the wind, changing direction only as necessary to miss obstructions.

(9) After landing, get out of the airplane as quickly as possible and remain outside.

3. RUNAWAY PROPELLER.

a. Failure of the governor to operate properly may result in a runaway propeller. A runaway propeller goes to full low pitch and may result in an engine rpm as high as 3600 or more. When such a failure occurs, the only method of reducing the rpm is to pull the throttle back. In doing this, it is highly important to make use of the allowable maximum overspeed (diving) rpm of 3240, given on the Power Plant Chart *(figure 15)*, and to reduce the IAS to approximately 140 mph in order to obtain the maximum horsepower available. The following procedure is recommended:

(1) Pull throttle back to obtain 3240 rpm.

(2) Raise nose of airplane to lose speed, and then descend, using flaps to keep speed reduced to approximately 140 mph.

(3) When over landing field, lower gear and come in at normal landing speed.

4. EMERGENCY RELEASE OF BOMBS OR DROPPABLE FUEL TANKS.

The bombs or droppable fuel tanks are released by pulling out on both emergency bomb release handles at left side of instrument panel.

Section IV

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Before emergency release of canopy in flight, drop seat and lower head as far as possible.

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(a) Raise seat to topmost position.

(b) If possible, reduce speed and trim airplane to fly "hands off."

(c) Disconnect headphones and oxygen tube.

Note

If jump is made at high altitude, turn the control on the oxygen regulator to 100 percent oxygen, and inhale as much oxygen as possible before jumping.

(d) Rise to a crouched position in seat, placing right foot on seat and left foot against left longeron. Grasp right longeron with right hand and right side of windshield with left hand. *(See figure 17.)*

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The right side is recommended because the slipstream will help you clear the airplane. If this method is used, the wing will either pass your body, or it will be possible to slide off the wing without striking the empennage.

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WARNING

Before emergency release of canopy in flight, drop seat and lower head as far as possible.

(6) If a long runway is available, and if there is sufficient time and altitude to properly plan an approach, lower the landing gear. If landing under any other condition, keep the gear up; you will stand less chance of injury by making a belly landing.

(7) Lower the flaps approximately 30 degrees, saving the last 20 degrees of flap to overcome possible mistakes in judgment. Lower flaps fully when proper landing is assured.

Note

The wing flaps cannot be lowered unless the landing gear control lever is in "NEUTRAL."

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(9) After landing, get out of the airplane as quickly as possible and remain outside.

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(1) Pull throttle back to obtain 3240 rpm.

(2) Raise nose of airplane to lose speed, and then descend, using flaps to keep speed reduced to approximately 140 mph.

(3) When over landing field, lower gear and come in at normal landing speed.

4. EMERGENCY RELEASE OF BOMBS OR DROPPABLE FUEL TANKS.

The bombs or droppable fuel tanks are released by pulling out on both emergency bomb release handles at left side of instrument panel.

5. COOLANT FLAP EMERGENCY OPERATION.

If under any condition an excessive coolant temperature persists, first try the manual "OPEN" position of the flap electrical control switch. If, after approximately 20 to 30 seconds, the temperature remains high and failure of the coolant flap actuator is indicated, pull the emergency release lever, provided on later airplanes. One quick pull up will open the flap to a minimum of 7 inches.

The emergency control will extend the flap approximately 5½ inches beyond the flap setting at the time of release; therefore, if the high coolant temperature was not caused by actuator failure, an undesirable cooling condition may result from use of the emergency control. To check this possibility, after using the emergency release, hold the electrical control switch in the closed position for approximately 20 seconds. This will ensure that the flap is not extended beyond 7 inches if the electrical actuator is functioning at all. Then turn the switch to "OFF" for the remainder of the flight.

When the emergency release has been used, low power operation should be avoided to prevent the coolant temperature from going below the minimum allowable limit as a result of the greater flap opening. There is no provision for emergency closing of the flap, nor can the emergency release be reset in flight.

6. LANDING GEAR EMERGENCY OPERATION.

In the event of hydraulic system failure, the landing gear may be lowered by placing the landing gear control handle in the "DOWN" position and yawing sideways. A spring bungee will help the gear to go to the down-locked position. However, if the red landing gear warning light illuminates or horn sounds when the throttle is retarded (indicating an unsafe condition), pull the emergency lowering handle, located on the cockpit floor just forward of the control stick, and then yaw the airplane sideways to force the gear into the locked position.

Note

If the gear will not extend after pulling the emergency lowering handle, the following procedure, though not a positive solution, may produce the desired result: With the landing gear control lever in the "DOWN" position, pull upward forcibly on the wing flap control handle to a position above the 0-degree setting and hold there. This will shut off all hydraulic pressure to the landing gear and

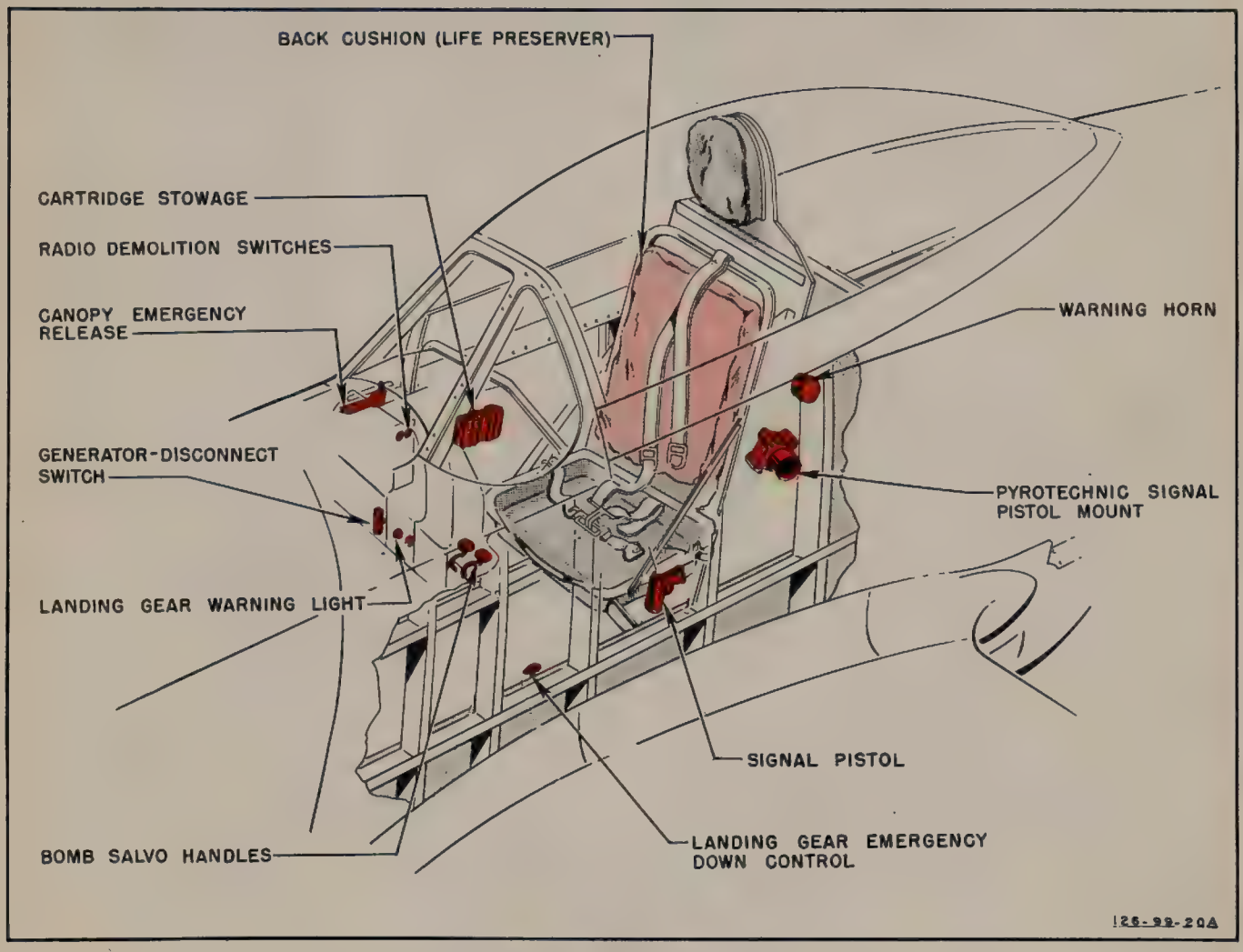


Figure 19—Emergency Equipment

should permit the fairing doors to drop open and the gear to extend.

7. LANDING IN WATER (DITCHING).

a. The airplane should be ditched only as a last resort. If, on an overwater flight, trouble arises and you are quite certain that you will not be able to reach land, leave the airplane while in flight. However, if it is not possible to maintain sufficient altitude for a successful parachute drop, ditching is the only remaining procedure. The instructions for ditching are as follows *(figure 18)*:

(1) If bombs or droppable tanks are installed, release them immediately.

(2) Release sliding canopy. *(See "WARNING" note in paragraph 1. a. (1) in this section.)*

(3) Be sure your shoulder harness and safety belt are fastened securely, as there is a violent deceleration of the airplane upon final impact.

(4) Move carburetor air control forward to "UNRAMMED HOT AIR" position to close ram air gate.

(5) Land into the wind with flaps half down and landing gear up. Approach with one wing low (about 20 degrees) and speed just enough above stalling to maintain lateral control. Kick hard inside rudder just as the low wing tip hits the water, so as to spin the airplane around on the surface. This is known as "landing with a swerve" and, although it is a difficult maneuver, it prevents the severe diving and extremely high deceleration that always result when a straight landing is made. As soon as the airplane comes to rest, get out immediately.

WARNING

Get out quickly upon landing. After the final impact, the airplane will sink very rapidly, only remaining above the surface of the water for a period of 1½ to 2 seconds.

8. EMERGENCY USE OF OXYGEN.

If for any reason there is a lack of oxygen, immediately turn the control on the regulator to 100 percent oxygen.

9. MISCELLANEOUS EMERGENCY EQUIPMENT.

a. RADIO DEMOLITION SWITCH.—This switch, on the right side of the cockpit, controls a charge for demolishing the identification radio in an emergency. If identification set is installed, press both buttons simultaneously to set off the charge.

b. FIRST-AID KIT.—The contents of the first-aid kit are to be used only in an emergency, when medical aid is not available. Use contents of kit in accordance with the directions contained therein.

c. LIFE PRESERVER.—The back cushion on the seat is filled with kapok and may be used as a life preserver.

d. LIFE RAFT.—A Type AN-R-2A one-man life raft may be used in place of a seat cushion when using a back-type pack parachute.

Section V

OPERATIONAL EQUIPMENT

1. GUNNERY EQUIPMENT.

a. GENERAL.

(1) DESCRIPTION.—Either of two gun installations may be used: a maximum load of three fixed .50-caliber guns in each wing, or an alternate load of two guns in each wing. The maximum load includes 390 rounds of ammunition for each inboard gun and 260 rounds for each center and outboard gun. When the alternate installation is used, the center guns are removed, and 490 rounds of ammunition are provided for each outboard gun. A K-14A or K-14B computing gun sight is installed on the instrument shroud, with a reticle diameter control incorporated in the throttle twist grip. Spare gun sight lamps are in a panel to the right of the electric switch panel. A Type B-6 gun and bomb control switch assembly is installed in the control stick grip. A Type N-6 G.S.A.P. camera is located in the leading edge of the left-wing panel. To prevent damage to the camera lens during take-off and landing, a spring-loaded door is installed over the gun camera cutout. This door is automatically opened when the gear retracts.

(2) OPERATION.

(a) On missions requiring gun heat, turn "ON" gun heater switch immediately after starting engine.

(b) Turn gun and camera safety switch to "CAMERA AND SIGHT." On K-14A gun sight, turn gyro motor "ON-OFF" switch on selector-dimmer control to "ON." On the K-14B gun sight, the "ON-OFF" switch has been eliminated and the gyro motor is turned on when the battery disconnect switch is moved to "ON."

(c) On combat missions, turn gun and camera safety switch to "GUNS, CAMERA, AND SIGHT" as soon as the airplane is safely off the ground.

(d) Fire guns by squeezing trigger on control stick grip. When camera only is desired, turn gun safety switch to "CAMERA AND SIGHT" and squeeze trigger.

Note

When the battery switch is on, the heaters in the camera will function automatically at low temperature.

(e) Before landing, make sure that the gun and camera safety switch and the gun heater switch are "OFF."

b. K-14A OR K-14B COMPUTING GUN SIGHT.

(1) DESCRIPTION.—The K-14A or K-14B sight computes the correct lead angle at ranges of from 200 to 800 yards. The sight contains two optical systems, fixed and gyro. The fixed optical system projects on the reflector glass a cross surrounded by a 70-mil ring. The 70-mil ring can be blanked out by means of the lever on the left of the sight. Normally blanked out, the ring is used only in case of mechanical failure of the gyro, or for ground strafing. The gyro optical system projects on the reflector glass a pattern of six diamonds surrounding a central dot. The size of the pattern is varied by changing the setting of the span scale lever on the face of the sight and by rotating the throttle control twist grip. The selector-dimmer control panel is located on the cockpit floor directly below the engine control quadrant.

(2) TESTING THE GUN SIGHT.

(a) While on the ground, move gun and camera safety switch to "CAMERA AND SIGHT." On K-14A gun sight, turn gyro motor "ON-OFF," switch on selector-dimmer control to "ON"; on K-14B gun sight, make sure battery-disconnect switch is "ON." Rotate dimmer rheostat until desired reticle brilliance is obtained.

(b) Set selector to "FIXED AND GYRO." Both the fixed and gyro reticles will appear on the reflector. The circle of the

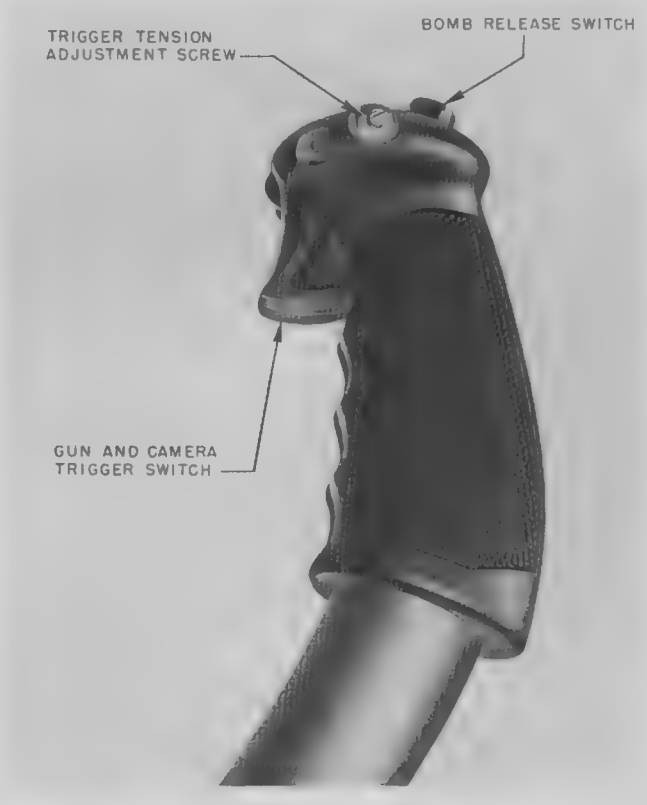


Figure 20—Gun and Bomb Control Switches

fixed reticle may be blanked out with lever at left of sight.

(c) Make sure dot of the gyro is superimposed on the fixed cross. This is done by switching selector switch back and forth from "FIXED AND GYRO" to "GYRO."

(d) Take off and fly in a circle at a constant rate of turn. Rotate the twist grip on the throttle slowly and note that, with the sight set for long range (small diameter reticle), the gyro reticle lags the fixed cross to a greater degree than when the sight is set for short range (large diameter reticle).

(3) COMBAT OPERATION OF GUN SIGHT.

(a) Identify your opponent; then set the span scale to correspond with the enemy type.

(b) Position your eyes 6 to 9 inches from the sight, and fly your airplane so that the enemy appears within the gyro reticle. Then rotate the throttle twist grip until the span of the enemy airplane fills the gyro reticle.

(c) Continue to rotate throttle twist grip, keeping the gyro reticle adjusted to the span of the enemy airplane—then fire!

(4) OPERATIONAL NOTES.

(a) Keep sight on whenever the presence of the enemy is possible.

(b) When not using the sight and when maneuvering into position for attack, *keep the sight set at shortest range* (large diameter gyro reticle) and decrease the diameter to correspond to the enemy's size.

(c) Track the target before firing. Continually frame the target, by operating the twist grip, while tracking for a minimum period of one second; then fire. The gyro sight computes correctly *only* after the target has been correctly framed and tracked for a minimum period of one second.

(d) Learn to use the sight in place of your flight instruments. Note that, with the selector set for normal operation (fixed and gyro), the relative positions of the fixed and gyro reticles indicate what your airplane is doing. If the cross and dot are superimposed, you are flying in a straight line.

(e) For firing at a stationary ground target, use the fixed part of the sight.

2. ZERO RAIL ROCKETS.

a. DESCRIPTION.—Ten zero rail rockets can be carried on the underside of the wings. If bombs or drop tanks are installed, only six rockets may be carried. The armament switches are located on the front switch panel.

b. OPERATION.

(1) Turn "RX TO BE FIRED" dial to "1."

(2) Place bomb-rocket selector switch in "ROCKETS" position.

Note

When this switch is in "ROCKETS," the bomb release circuits are inoperative.

(3) To nose arm rockets for instant detonation on impact, move arming switch to "INST."; for delayed detonation, move to "DELAY."

(4) To fire rockets one at a time, turn rocket release control switch to "SINGLE" and press bomb release button on control stick, once for each rocket.

(5) To fire all rockets in train, turn control switch to "AUTO" and press bomb release button for approximately one second.

Note

Firing order of rockets, alternately from left wing to right wing, in train, is as follows:

Left Wing		Right Wing
13795	Inboard	610842

Rockets 7, 8, 9, and 10 are not installed when bombs are carried.

3. BOMBING EQUIPMENT.

a. GENERAL.—A removable bomb rack is installed on the underside of each wing panel. Each rack will hold one 100, 300, 500, or 1000-pound bomb. Depth charges, chemical tanks or drop tanks may be carried on the bomb racks when bombs are not installed. The bomb racks have an electrical, selective release system and an alternate mechanical, selective release system. The electrical release of bombs is the normal release. Two bomb salvo handles (at the left of the electric switch panel) operate the selective mechanical release of bombs or tanks. The bomb system electrical controls consist of a bomb release switch on top of the control stick, and two bomb arming switches and a bomb-rocket selector switch on the front switch panel.

b. ELECTRICAL RELEASE.—The bomb-rocket selector switch has the following positions for bombing: "ALL," "OFF," and "TRAIN." With the selector switch on "ALL," bombs are released simultaneoulsy when the release switch is pressed. When the selector switch is on "TRAIN" and the bomb release switch is pressed, the left bomb is released; when the bomb release switch is pressed again, the right bomb is released. The bomb release circuit is inoperative when the selector switch is in the "OFF" position.

Note

Bombs may be released when the airplane is in any attitude of flight from a 30-degree climb to a vertical dive.

When the bomb release system is not to be used, place the bomb-rocket selector switch in "SAFE," and the arming switches "OFF."

(1) TRAIN RELEASE OPERATION.

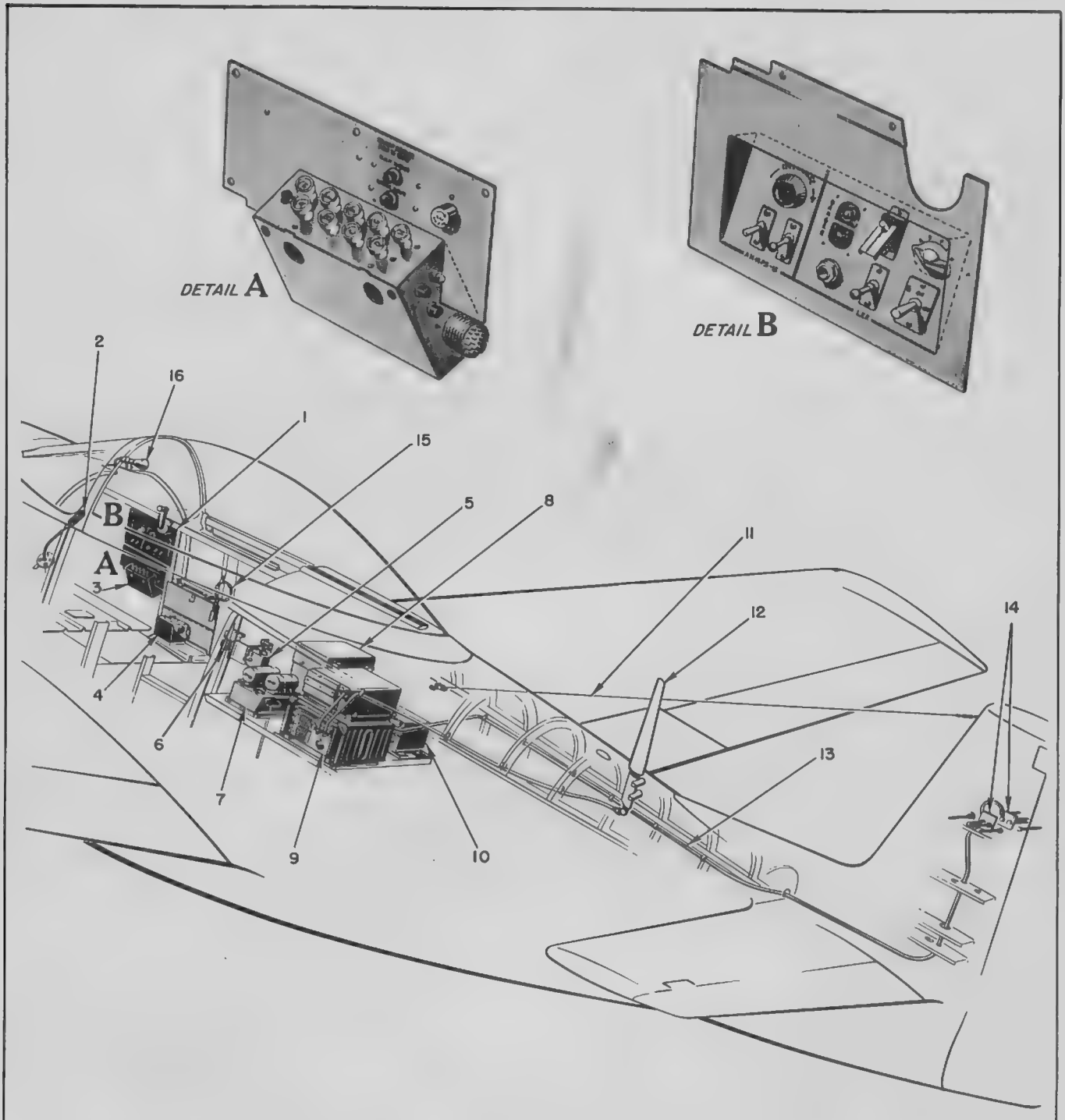
(a) Place arming switches in desired position.

(b) Place bomb-rocket selector switch on "TRAIN."

(c) Press bomb release switch button momentarily to release bomb on left rack.

(d) Press bomb release button again to release bomb on right bomb rack.

(e) Move bomb arming switch to "OFF," bomb-rocket selector switch to "OFF."



1	RADIO CONTROL PANEL	7	AN/ARC-3 RADIO POWER SUPPLY	13	AN/APS-13 ANTENNA CABLE
2	THROTTLE SWITCH	8	SCR-695-A RADIO SET	14	AN/APS-13 ANTENNA ARRAY
3	AN/ARC-3 CONTROL BOX	9	AN/ARC-3 RADIO SET	15	HEADSET AND MICROPHONE CORDS
4	RADIO RANGE RECEIVER	10	AN/APS-13 RADIO SET		
5	INERTIA SWITCH SCR-695	11	RADIO RANGE RECEIVER ANTENNA	16	ID-42/APS-13 TAIL WARNING INDICATOR LAMP
6	AN/APS-13 RADIO SIGNAL BELL	12	AN/ARC-3 ANTENNA MAST		

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Figure 21—Radio Installation Complete—Early Airplanes

(2) SIMULTANEOUS RELEASE OPERATION.

(a) Place bomb arming switches in desired position.

(b) Place bomb-rocket selector switch on "ALL."

(c) Press bomb release switch; both bombs will release.

(d) Move bomb arming switches to "OFF," bomb-rocket selector switch to "OFF."

c. MECHANICAL RELEASE.—Two handles at the left side of the instrument panel provide mechanical release of bombs or drop tanks from the bomb rack. Pulling one handle will release one bomb or tank. Pulling both handles simultaneously will jettison the bomb load and obtain simultaneous bomb release. Bombs can be dropped safe or armed by placing arming switches in the desired position before pulling salvo handles.

d. OPERATION OF CHEMICAL TANKS.—Lift the arming switches to chemical "LEFT" or "RIGHT" or both; then press bomb release button on control stick until smoke appears.

CAUTION

"ARM" position of arming switches must not be used at any time when chemical tanks are installed.

WARNING

Be sure that the bomb-rocket selector switch is in the "OFF" position to ensure that the chemical tanks will not be jettisoned when the bomb release button is pressed.

4. COMMUNICATION EQUIPMENT.

a. GENERAL.—The communication equipment consists of the following: an AN/ARC-3 command radio with a BC-1206-A, B, or C range receiver and an AN/ARA-8 homing adapter installed in conjunction; an SCR-695-A identification set; and an AN/APS-13 tail warning radio. Additional equipment includes a signal pistol and recognition lights.

b. COMMAND SET AN/ARC-3.

(1) DESCRIPTION.—This equipment provides remote operation on eight frequency channels for plane-to-plane and plane-to-ground communication. A control box is located on the radio control panel at the right side of the cockpit with eight red channel-selector buttons on the box designated by letters "A" through "H."

(2) OPERATION.

(a) Push any one of the eight channel-selector buttons on the control box and allow approximately 30 seconds for the set to warm up.

(b) To stop the equipment, depress the "OFF" button and the small metal locking button, located forward of the channel-selector buttons, at the same time.

c. RANGE RECEIVER BC-1206-A, B, or C.

(1) DESCRIPTION.—This receiver covers a frequency range of 200-400 kc and is mounted on the floor at the right of the seat.

(2) OPERATION.

(a) Turn hexagonal control knob clockwise to turn set on and to increase volume. Normally the range receiver is connected so it can be monitored simultaneously with AN/ARC-3 equipment.

(b) Turn the hexagonal control knob fully counterclockwise to turn the receiver off.

(c) In early installations it is necessary to have the AN/ARC-3 receiver operating to hear the range receiver, and the VHF volume control affects both receivers. If it is necessary to operate the range receiver separately due to failure of AN/ARC-3 equipment, remove AN/ARC-3 connecting plug from range receiver and plug headphones directly into the range receiver and operate as in *(a)* and *(b)* preceding.

(d) In later installations both receivers may be operated simultaneously or independently with the headphones connected to AN/ARC-3 equipment.

d. HOMING ADAPTER AN/ARA-8.

(1) DESCRIPTION.—This adapter unit is used in conjunction with the AN/ARC-3 VHF equipment to permit homing on any transmitted carrier within the frequency range of 120 to 140 megacycles. In addition, this equipment may be used for air-to-air homing for purposes of rendezvous. Homing can be accomplished on CW, MCW, and audio pulse signals. Controls are provided above the VHF control box at the right side of the cockpit.

(2) OPERATION.

(a) To start the equipment, place the "HOMING-COMM-TRANS" switch in the "HOMING" position.

(b) To stop the equipment, move the "HOMING-COMM-TRANS" switch to the "COMM" position.

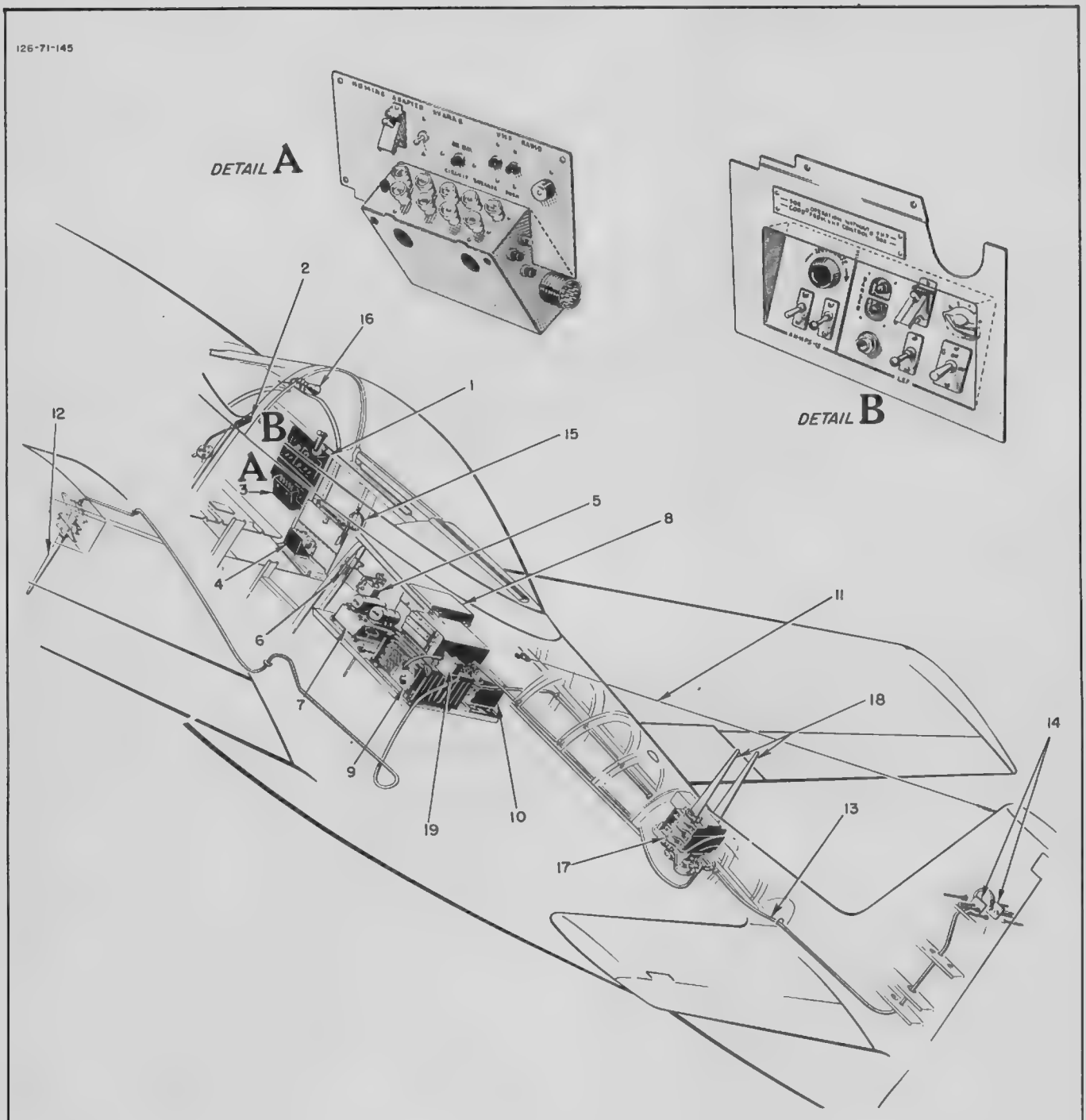
e. RADAR EQUIPMENT AN/APS-13.

(1) DESCRIPTION.—The radar equipment visibly and audibly warns the pilot of the approach of other aircraft from behind within a designated angle of protection. Controls for operating the equipment are located on the radio control panel at the right side of the cockpit.

(2) OPERATION.

(a) Move "ON-OFF" toggle switch to the "ON" position. After warming up for approximately 3 minutes the warning indicator light should illuminate and the warning bell should sound. The light and bell should always function whenever the equipment is operated on the ground and until the airplane reaches an altitude of approximately 3000 feet.

(b) To check equipment during flight, move "TEST-ON" switch to "ON" and hold. If indicator illuminates and warning bell rings, the set is functioning properly. Let the "TEST-ON" switch drop to its normal position.



1 RADIO CONTROL PANEL
2 THROTTLE SWITCH
3 AN/ARC-3 CONTROL BOX
4 RADIO RANGE RECEIVER
5 INERTIA SWITCH SCR-695-A
6 AN/APS-13 RADIO SIGNAL BELL
7 AN/ARC-3 RADIO POWER SUPPLY
8 SCR-695-A RADIO SET
9 AN/ARC-3 RADIO SET
10 AN/APS-13 RADIO SET
11 RADIO RANGE RECEIVER ANTENNA
12 AN/ARC-3 ANTENNA MAST
13 AN/APS-13 ANTENNA CABLE
14 AN/APS-13 ANTENNA ARRAY
15 HEADSET AND MICROPHONE CORDS
16 ID-42/APS-13 TAIL WARNING INDICATOR LAMP
17 AN/ARA-8 HOMING ADAPTER
18 AN/ARA-8 ANTENNA MASTS
19 RE-13/ARA-8 ANTENNA RELAY

Figure 22—Radio Installation Complete—Late Airplanes

f. IDENTIFICATION EQUIPMENT.—The identification equipment is controlled from the radio control panel on the right-hand side of the cockpit. For operating instructions, see the communications officer in charge. Detonator buttons and an inertia crash switch are provided with this equipment.

g. PYROTECHNIC RECOGNITION SIGNAL PISTOL.

(1) DESCRIPTION.—An M-8 pyrotechnic pistol is stowed in a holster at the left of the seat. A pistol mount is located directly above the holster. A cap, chained to the mount, covers the port when the pistol is not installed. A cartridge container bag is on the cockpit floor at the right of the seat.

(2) OPERATION.

(a) Remove cover cap from mount.

(b) Remove pistol from stowage holster, and insert muzzle of pistol in the mount so that the lugs on the pistol barrel slip into the slots. Then, while depressing the mount release trigger, turn the pistol to right or left as far as it will go.

(c) To load pistol, press breech lock lever (behind the mount release trigger) and apply force on the butt until the breech opens. Then insert signal cartridge into the chamber and close breech. Pistol is cocked automatically when breech is closed.

WARNING

Do not load pistol except when it is in the mount, as no safety is provided.

h. RECOGNITION LIGHTS.—For operation of recognition lights, see section II, paragraph 18. *e.*

5. OXYGEN SYSTEM.

a. DESCRIPTION.—Oxygen is supplied from three Type F-2 low-pressure oxygen cylinders. A Type A-9, A-9A, A-10, or A-14 mask may be used with this equipment. A blinker flow indicator, pressure gage, and pressure breathing regulator, Type A-14, are on the right side of the cockpit above the map case.

Note

The oxygen panel is designed so that the pressure breathing regulator, Type A-14, can be replaced by a demand regulator, Type A-12, when desired.

The blinker flow indicator operates with the breathing of the wearer, indicating proper functioning of the system. The oxygen cylinders may be refilled, without removing them from the airplane, by means of a filler valve located on the left side of the fuselage just aft of the trailing edge of the wing. Normal full pressure for the system is 400 pounds per square inch.

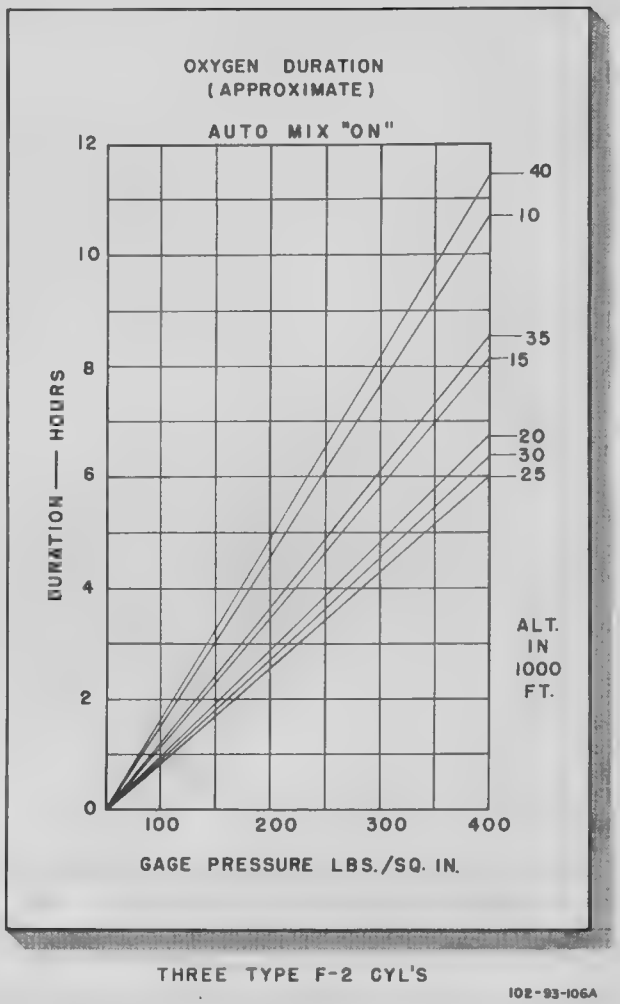


Figure 23—Oxygen Consumption Chart

6. HEATING, VENTILATING, AND DEFROSTING SYSTEM.

a. DESCRIPTION.—A heater burning a fuel-air mixture heats the cockpit and defrosts the windshield. The heater is located forward of the firewall with the ram air and combustion air ducts in the leading edge of the left wing panel. Heated air enters the cockpit through a controllable diffuser valve on the aft side of the firewall in the cockpit. Defroster ducts extend to the windshield panels from the diffuser. The heater is operated by a switch on the front switch panel. On the control pedestal a selector handle selects "AIR TO COCKPIT AND WINDSHIELD," "AIR TO COCKPIT ONLY," AIR TO WINDSHIELD ONLY," and "AIR OFF." An air temperature modulator is adjacent to the selector handle on the control pedestal. The air temperature modulator has two positions: "AUTOMATIC FOR HEATING" and "VENTILATION WHEN HEATER IS OFF." A pressure switch, activated by combustion air pressure, prevents the heater from being operated if air pressure falls below the required minimum. When the heater is not operating, the system may be used for ventilation.

b. OPERATION.

(1) Turn selector handle to desired position.

CAUTION

Never turn selector handle to "AIR OFF" when heater is in operation.

(2) Place temperature modulator in "AUTOMATIC FOR HEATING."

(3) Start heater by moving switch to "HIGH AND START."

(4) If desired, turn heater switch to "LOW."

(5) Stop heater by turning switch to "OFF."

7. MISCELLANEOUS EQUIPMENT.

a. PILOT'S RELIEF TUBE.—The relief tube horn is stowed in a bracket on the floor of the cockpit under the front of the pilot's seat.

b. DATA CASE.—A data case is fastened to the right side of the fuselage in the rear stowage compartment.

c. DROP MESSAGE CONTAINER.—A Type A-8 drop message container may be mounted on the left-hand side of the control pedestal in the cockpit.

d. FLIGHT REPORT HOLDER.—A flight report holder is mounted on the right-hand side of the center control pedestal in the cockpit.

e. ARM REST.—A folding arm rest is on the left longeron, aft of the engine control quadrant.

Section VI

EXTREME WEATHER OPERATION

1. WINTER OPERATION.

a. DESCRIPTION.

(1) GENERAL.—The primary extreme weather provisions on the P-51H Airplane are for winterization. These installations are described in the following paragraphs, with instructions for their use in the sequence they will be needed.

(2) OIL DILUTION SYSTEM.

(a) Operate engines at 1000 to 1200 rpm.

(b) Maintain oil temperature below 50°C and oil pressure above 15 pounds per square inch.

(c) Dilute as follows: 4° to −12°C (40°F to 10°F) 3 minutes maximum.

(d) For temperatures below −12°C (10°F) it will be necessary to drain the oil system and refill with warm oil before flight.

(3) CARBURETOR ICING PROTECTION.

(a) A carburetor ice guard screen is installed in the carburetor air intake duct. Should this screen ice over, a spring-loaded door will open automatically to admit air from the engine section to the carburetor.

(b) Engine compartment air will enter the induction system when the carburetor air control is moved from "RAM AIR" to "HOT AIR" position. This is done by moving the operating handle inboard and back, then outboard and forward. *(See bottom of figure 24.)*

(4) CARBURETOR AIR TEMPERATURE GAGE.—The carburetor air temperature gage is mounted on the lower left corner of the instrument panel.

(5) WING, ENGINE, AND PROPELLER COVERS.—The airplane is provided with an engine and a cockpit cover. Wing and propeller covers will be furnished by the AAF.

(6) GUN HEATERS.—The electrical gun heaters are controlled by a switch on the front switch panel.

(7) COOLANT RADIATOR EXIT FLAP.—A spring-loaded baffle in the exit flap makes the flap fully closing. When not installed, the baffle is stowed in the airplane as loose equipment.

b. OPERATION.

(1) STARTING ENGINE.—A normal start should be made by following the procedure outlined in section II. The following supplementary instructions are to be followed if any difficulty is encountered when starting the engine.

(a) Preheat the engine and the instrument panel before attempting to start the engine. In extremely cold weather, it may be necessary to preheat the oil and coolant before starting.

(b) Use a portable generator instead of the conventional battery cart for starting the engine, as batteries quickly lose their charge at below freezing temperatures.

(c) Pull propeller through 5 or 6 revolutions by hand before engaging starter.

(d) When sub-zero weather makes starting difficult, move the mixture control from "IDLE CUT OFF" to "RUN" at the same time the starter is engaged with the engine. However, it is essential that the mixture control be moved back to the "IDLE CUT OFF" position if the engine does not start before the fourth revolution. Normally, the engine will start on the second or third revolution. However, if the engine does not start, turn "OFF" the ignition switch and pull the engine through by hand with the throttle fully opened to clear the engine of excess fuel.

(e) If the engine fails to start, moisture on the spark plugs may be the cause. Remove at least one plug from each cylinder and dry the points. Make another attempt to start the engine after replacing the plugs.

(f) Start the engine normally, without regard to the oil dilution system. After starting engine, if a heavy viscous oil is indicated by oil pressure that is too high, or by oil pressure that fluctuates or falls back when the engine rpm is increased, the dilution switch may be pushed "ON" (3 minutes maximum) to dilute the oil and correct this condition. This method should be used only if time and extreme temperature conditions do not permit normal engine warm-up.

CAUTION

When it is not known to what percentage the oil has been diluted, it is necessary to drain and refill the oil system before flight.

g. Do not run the engine at more than 1300 rpm until the oil has reached a temperature of 20°C.

Note

Engine warm-up may be facilitated by moving carburetor air control to the "HOT AIR, OPEN" position.

(2) TAKE-OFF.

(a) Do not take off with snow, ice or frost on the wings. Even loose snow cannot be depended upon to blow off, and even a thin frost layer can cause loss of lift and very

treacherous stalling characteristics. Since frost formation can be very rapid, it may be necessary to taxi out to the take-off position before removing the protective covers from the flight surfaces.

Note

When the outside air temperature is 0°C (32°F) or lower, it is advisable to use carburetor heat during take-off to improve vaporization of fuel.

(b) When taking off or landing on a narrow strip of clear ice, cross winds are particularly dangerous because of poor maneuverability caused by lack of traction. If the wind is gusty, the airplane may be blown completely off the ice before control can be regained.

(3) FLIGHT.

(a) After taking off from snow or slush-covered fields, operate the landing gear and flaps through several cycles to prevent them from freezing in the up position.

(b) Turn "ON" the pitot tube heater switch. This switch should not be "ON" with the airplane on the ground, as there is insufficient cooling in the pitot head to prevent overheating.

(c) When icing of the carburetor is indicated by irregular engine operation, move carburetor cold air control to one of the "HOT AIR" positions.

CAUTION

Because of the constant-speed propeller governor and the automatic manifold pressure regulator, it is difficult to determine whether ice is forming other than by irregular engine operation, since neither the rpm nor the manifold pressure should change.

(d) Increase propeller speed momentarily by approximately 200 rpm every half-hour to assure continued governing at extremely low temperatures. Return to the desired cruising rpm as soon as the tachometer shows that the governor is functioning.

(e) Stay on a prearranged flight course as closely as possible, so that searchers will be able to find you if you are forced down. Except in extreme emergency, it is better to land or crash-land than to bail out.

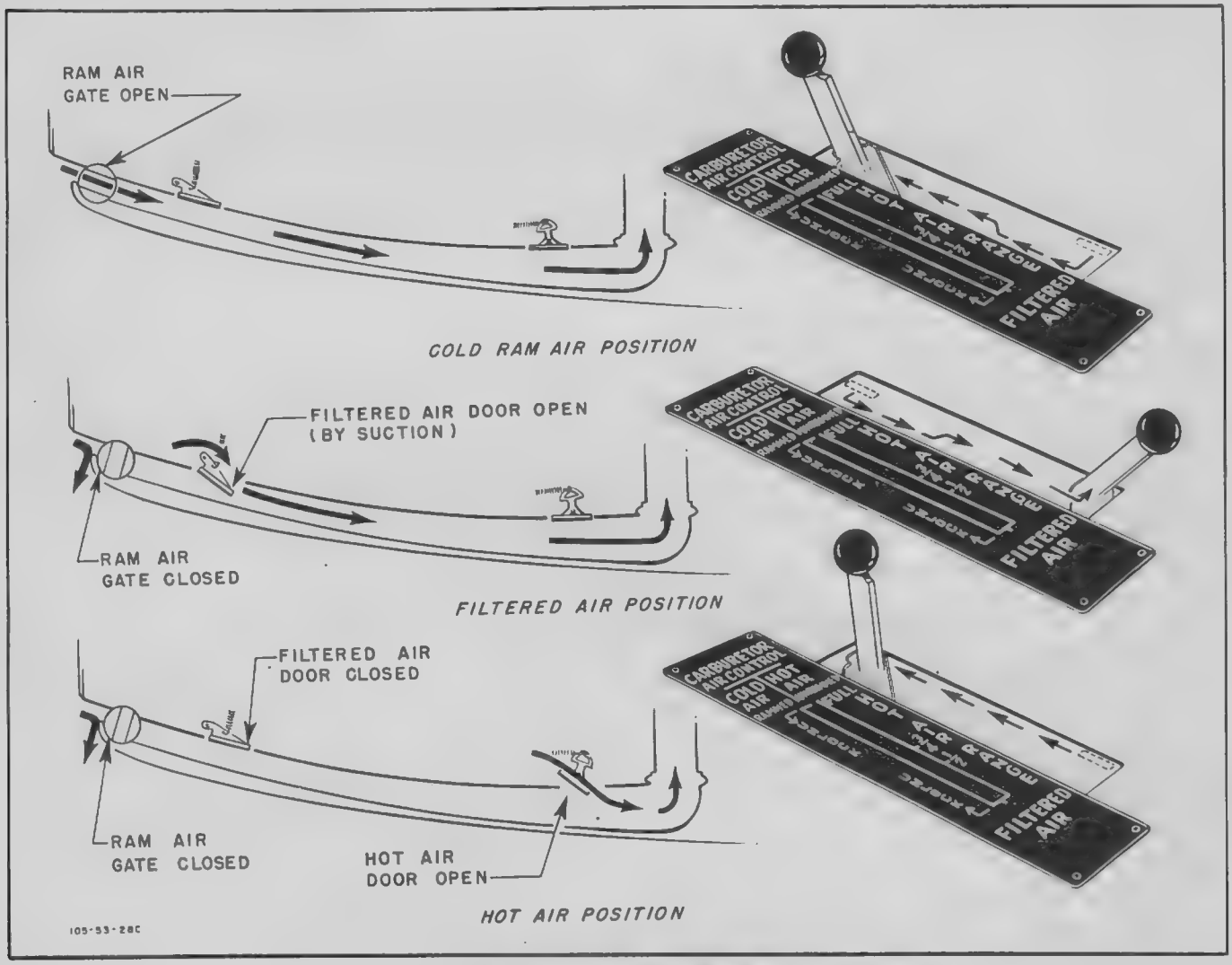


Figure 24—Operation of Carburetor Air Induction System

(4) LANDING.—Temperature inversions are common in winter, and the ground may be 15° to 30°C (27° to 54°F) colder than that at altitude. Therefore, be careful to avoid excessive cooling when letting down. Lower the landing gear and use flaps to reduce airspeed while descending. Retain considerable power, and if possible, maintain the oil temperature above 20°C and the coolant temperature above 60°C during all letdowns. Lower readings than these may result in the engine cutting out or the failure of the engine to respond when the throttle is advanced.

Note

When the outside air temperature is 0°C (32°F) or lower, it is advisable to use carburetor heat during landing to obtain better vaporization of fuel. This also helps prevent the engine from cutting out.

(5) AFTER LANDING.—To obtain sufficient dilution of the oil to facilitate starting, idle or stop the engine to cool it before starting dilution. This will prevent rapid evaporation of the gasoline and ensure that the viscosity of the oil has been reduced sufficiently. In most cases it will be found that the engine has cooled sufficiently for dilution by the time the airplane reaches the flight line. Dilute oil as follows:

(a) Operate the engine at 1000 rpm and maintain an oil temperature at 50°C or less.

(b) For ground temperatures of 5°C (40°F) or less, hold oil dilution switch in the "ON" position for 3 minutes (maximum); then stop engine and release oil dilution switch.

Note

It has been determined through tests conducted on V-1650 engines that diluting the oil more than 10 percent will cause the scavenge system to fail. Therefore, restrict the period of oil dilution to a *maximum* of 3 minutes. When the outside air temperature is such that 3 minutes oil dilution is insufficient, drain the oil and refill the system with warm oil before starting the engine.

2. DESERT OPERATION.

Dust filters are installed in the air intake ducts, at each side of the engine compartment. When conditions warrant, or at the direction of the Operations Officer, use "FILTERED AIR" for starting, take-off, and landing. Dust covers are provided as loose equipment for use when on the ground.

Appendix I

OPERATING CHARTS, TABLES, CURVES AND DIAGRAMS

1. ARMOR PROTECTION.

Armor protection is illustrated in figure 25.

2. FLIGHT PLANNING.

a. GENERAL.

(1) A series of charts on the following pages is provided to aid in selecting the proper power and altitude to be used for obtaining optimum range of the airplane. Charts are provided for each airplane configuration with the probable ranges of gross weights.

(2) If the flight plan calls for a continuous flight where the desired cruising power and airspeed are reasonably constant after take-off and climb and the external load items are the same throughout the flight, the fuel required and flight time may be computed as a single section flight. If this is not the case, the flight may be broken up into sections, and each leg of the flight planned separately, since dropping of external bombs or tanks causes considerable change in range and airspeed for given power. (Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed.)

b. USE OF CHARTS.

(1) Although instructions for their use are shown on the Flight Operation Instruction Charts, the following expanded information on proper use of the charts may be helpful.

(2) Select the Flight Operation Instruction Chart for the gross weight, and external loading to be used at take-off. The amount of gasoline available for flight planning purposes depends upon the reserve required and the amount required for starting and warm-up. Reserve should be based on the type of mission, terrain over which the flight is to be made, and weather conditions. The fuel required for climb and time to climb to various altitudes is shown on the Take-off, Climb, and Landing Chart. Fuel remaining after subtracting reserve, warm-up, and climb fuel from total amount available is the amount to be used for flight planning.

(3) Select a figure in the fuel column in the upper section of the chart equal to, or the next entry less than, the amount of fuel available for flight planning. Move horizontally to the right or left and select a figure equal to, or the next entry greater than, the distance (with no wind) to be flown. Operating values contained in the lower section of the column number in which this figure appears represent the highest cruising speeds possible at the range desired. It will be noted that the ranges listed in Column I are figured for the altitude which gives the least miles per gallon. The ranges shown in Column II and other columns to the right of Column II can be obtained at any of the altitudes listed in the altitude column. All of the power settings listed in a column will give approximately the same number of miles per gallon if each is used at the altitude shown on the same horizontal line with it. Note that the time required for the flight may be shortened by selection of the higher altitudes. The flight duration may be obtained by dividing the true airspeed of the flight altitude into the air miles to be flown.

(4) The flight plan may be readily changed at any time enroute, and the chart will show the balance of range available at various cruising powers by following the Instructions for Using Chart printed on each chart.

Note

The preceding instructions and following charts do not take into account the effect of wind. Adjustment to range values and flight duration to allow for wind may be made by any method familiar to the pilot, such as by the use of a flight calculator or a navigator's triangle of velocities.

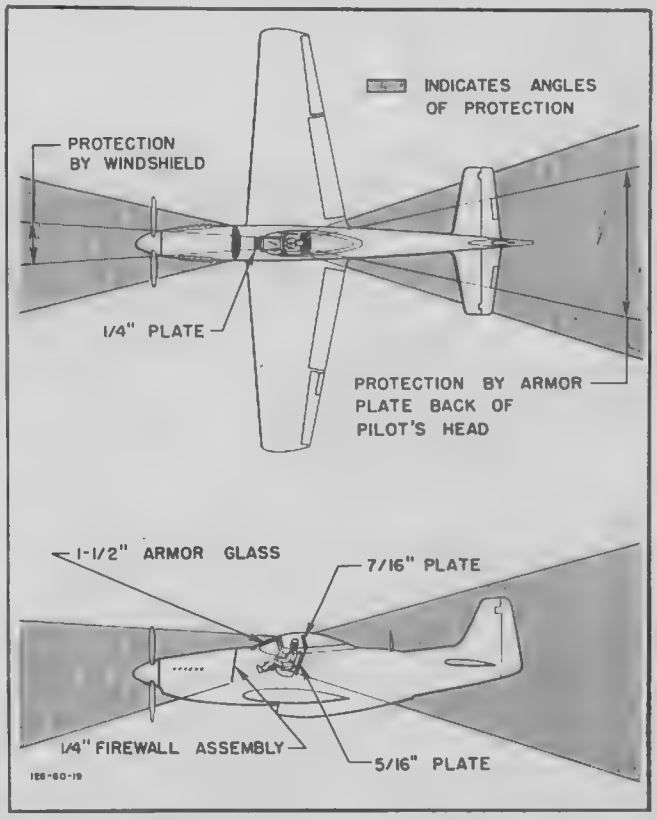


Figure 25—Armor Protection

c. SAMPLE PROBLEMS.

(1) PROBLEM 1.—To fly 600 miles at 25,000 feet to the objective, to fight at military power for 15 minutes when over objective, and then to return to base.

(a) Reference to the Flight Operation Instruction Charts indicates that two 110-gallon combat tanks and the 50-gallon fuselage tank will be required. *(See figure 30.)*

(b) Reference to the Take-off, Climb, and Landing Chart *(figure 26)* shows that 70 gallons of fuel will be used in climbing to 25,000 feet (for the take-off gross weight of 11,200 pounds). This leaves 405 gallons for cruising and combat, assuming that the climb was made near the base with a rendezvous at 25,000 feet.

(c) The engine data in the upper left-hand corner of figure 30 indicates that military power (61 in. Hg and 3000 rpm) uses 196 gph; thus 15 minutes of flight at military power will require 49 gallons. This will leave 356 gallons (405—49) for cruising.

(d) The range shown in Column IV for 340 gallons is 1390 miles, which will leave approximately 16 gallons as reserve. *(See paragraph (e) following, for computed reserve fuel.)*

(e) Vertically below in the table and opposite 25,000 feet, read 2600 rpm, low blower, 340 mph TAS, full throttle and 89 gph fuel flow, using "RUN" mixture position. Range to be covered divided by TAS equals the hours of flight (600 ÷ 340 = 1.77 hours, one way). Hours multiplied by fuel flow equals gallons consumed (1.77 x 89 = 158 gallons). The return trip must be computed from figure 27 (no external load), inasmuch as the combat tanks will have been dropped prior to entering the combat zone. The operating conditions for the return trip will be 2400 rpm, low blower, 355 mph TAS, full throttle and 74 gph fuel flow, using the run mixture position. The time required will be 600 ÷ 355 or 1.69 hours. The fuel used will be 1.69 x 74 or 125 gallons. Thus, the total fuel used for the entire trip will be 283 gallons. The reserve fuel will be 73 gallons (356 gallons from paragraph *(c)*, less 283 equals 73).

(2) PROBLEM 2.—During such a flight as that described in Problem 1, changed weather or some other factor might make it necessary for the pilot, on his return trip, to change the operating conditions. For example, it is necessary that he go down to 15,000 feet altitude. First he obtains a fix on his position and finds that 400 statute miles remain to be covered. Reference to Column IV of the chart shows that at 15,000 feet the cruising conditions should be 2050 rpm and 315 mph TAS. This will require full throttle MP, and the fuel consumption will be 68 gph. Checking the figures: .56 hours were flown at 25,000 feet and 42 gallons of fuel were consumed. Range remaining divided by TAS equals hours flight remaining (400 ÷ 315 = 1.27 hours remaining). Hours times fuel flow equals gallons fuel used (1.27 x 68 = 87 gallons required to finish the flight at 15,000 feet). Thus, 356 less 287 (158 + 129) = 69 gallons fuel reserve remaining. Thus, by changing from 25,000 to 15,000 feet and using the cruising conditions from the chart, the trip will be completed, leaving approximately the same fuel reserve (73 gallons) calculated for the 25,000-foot trip. The factor which has changed is the time required for the trip, which increased 10 minutes.

(3) SELECTION OF CRUISING CONDITIONS.—If arrival over a check point is late because of head winds, similar reference to the charts and calculations will allow the pilot, while in flight, to select new cruising conditions for safe arrival at his destination.

AAFMC-527
4-1-44

AIRCRAFT MODEL(S)
P-51H

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
V-1650-9

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
11,000	0	0	1800	2700	2000	3000	2300	3300	2000	2800	2100	3100	2400	3400	2300	3200	2500	3400	2800	3900
	17	15	1400	2100	1500	2300	1800	2600	1500	2200	1600	2400	1900	2700	1700	2500	1900	2700	2200	3100
	34	30	1000	1600	1100	1800	1300	2100	1100	1700	1200	1900	1400	2100	1200	1900	1400	2100	1600	2400
	51	45	700	1200	800	1300	900	1500	700	1200	800	1400	1000	1600	800	1300	1000	1500	1200	1700
10,000	0	0	1600	2400	1800	2500	2000	2800	1700	2400	1800	2600	2100	3000	1900	2700	2100	2900	2400	3200
	17	15	1200	1800	1300	2000	1500	2300	1300	1900	1400	2100	1600	2400	1400	2100	1600	2300	1800	2500
	34	30	900	1400	1000	1500	1100	1800	900	1400	1000	1600	1200	1800	1000	1600	1200	1700	1300	2000
	51	45	600	1000	700	1100	800	1300	600	1000	700	1200	800	1300	700	1100	800	1200	900	1500
9000	0	0	1400	2000	1500	2200	1700	2500	1400	2100	1600	2300	1800	2500	1600	2300	1800	2500	2000	2800
	17	15	1000	1600	1200	1700	1300	2000	1100	1600	1200	1800	1400	2000	1200	1800	1300	1900	1500	2200
	34	30	700	1200	800	1300	1000	1500	800	1200	900	1400	1000	1500	900	1300	1000	1400	1100	1700
	51	45	500	800	600	1000	700	1100	500	900	600	1000	700	1100	600	900	700	1000	800	1200

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

OPTIMUM TAKE-OFF WITH 3000 RPM, 61 IN.HG. & 20 DEG. FLAP IS 80% OF CHART VALUES

DATA AS OF 11-20-44 BASED ON: ESTIMATED FROM P-51D DATA

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	AT SEA LEVEL BEST I.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL GAL. OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	AT 5000 FEET BEST I.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED	AT 10,000 FEET BEST I.A.S. MPH	AT 10,000 FEET BEST I.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED	AT 15,000 FEET BEST I.A.S. MPH	AT 15,000 FEET BEST I.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED	AT 20,000 FEET BEST I.A.S. MPH	AT 20,000 FEET BEST I.A.S. KTS	AT 20,000 FEET RATE OF CLIMB F.P.M.	AT 20,000 FEET FROM SEA LEVEL TIME MIN.	AT 20,000 FEET FROM SEA LEVEL FUEL USED	AT 25,000 FEET BEST I.A.S. MPH	AT 25,000 FEET BEST I.A.S. KTS	AT 25,000 FEET RATE OF CLIMB F.P.M.	AT 25,000 FEET FROM SEA LEVEL TIME MIN.	AT 25,000 FEET FROM SEA LEVEL FUEL USED
11,000	170	150	1200	15	170	150	1200	3.8	21	165	145	1200	7.7	27	160	140	1150	12.0	36	160	140	950	17.5	51	160	140	600	25	70
10,000	165	145	1500	15	165	145	1550	3.3	20	160	140	1550	6.6	25	160	140	1550	10.0	32	155	135	1350	13.5	43	155	135	950	18	57
9000	160	140	1850	15	160	140	1850	2.8	19	160	140	1900	5.2	23	155	135	1950	8.0	29	155	135	1700	11.0	38	155	135	1300	15	50
8000	160	140	2200	15	160	140	2250	2.2	18	155	135	2300	4.4	22	155	135	2350	6.6	26	155	135	2150	9.0	34	155	135	1700	12	44

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III):

DATA AS OF 11-20-44 BASED ON: WIND TUNNEL DATA

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	POWER OFF KTS	POWER ON MPH	POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
9000	130	115	130	115	1200	2300	1400	2400	1500	2600	1400	2400	1600	2600	1700	2800	3200	4300	3500	4600	3900	5000
8000	130	115	130	115	1100	2100	1200	2200	1400	2400	1300	2200	1400	2400	1500	2600	2900	3800	3100	4100	3400	4500

DATA AS OF 11-20-44 BASED ON: ESTIMATED FROM P-51D DATA

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure 26—Take-off, Climb, and Landing Chart

AAFMC-528 4-1-44

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9600 TO 8000 POUNDS

EXTERNAL LOAD ITEMS: WING RACKS

NUMBER OF ENGINES OPERATING:

LIMITS	RPM	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	51	LOW HIGH	RUN	15 MIN.		196 175

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I			FUEL	COLUMN II			COLUMN III			COLUMN IV			FUEL	COLUMN V		
RANGE IN AIRMILES			U.S.	RANGE IN AIRMILES			RANGE IN AIRMILES			RANGE IN AIRMILES			U.S.	RANGE IN AIRMILES		
STATUTE		NAUTICAL	GAL.	STATUTE		NAUTICAL	STATUTE		NAUTICAL	STATUTE		NAUTICAL	GAL.	STATUTE		NAUTICAL
880		770	255	1020		890	1060		920	1220		1060	255	1340		1160
830		720	240	960		830	1010		880	1150		1000	240	1260		1090
760		660	220	880		760	970		840	1060		920	220	1150		1000
690		600	200	800		690	880		760	980		840	200	1050		910
620		540	180	720		620	790		690	860		750	180	940		820
560		480	160	640		560	700		610	770		670	160	840		730
490		420	140	560		490	610		530	670		580	140	730		640
420		360	120	480		420	530		460	570		500	120	630		550
350		300	100	400		350	440		380	480		420	100	520		450
280		240	80	320		280	350		300	380		330	80	420		360
210		180	60	240		210	260		230	290		250	60	310		270
140		120	40	160		140	170		150	190		160	40	210		180
70		60	20	80		70	90		70	90		80	20	100		90

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]

MAXIMUM CONTINUOUS					PRESS ALT. FEET	(4.0 STAT. (3.48 NAUT.) MI./GAL.)						(4.4 STAT. (3.82 NAUT.) MI./GAL.)						(4.8 STAT. (4.17 NAUT.) MI./GAL.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
2700	46	RUN	103	440	380													2600	F.T.	RUN	86	415	360	40000	2400	F.T.	RUN	67	350	305
2700	46	RUN	98	425	370							2600	44	RUN	95	415	360	2400	F.T.	RUN	80	390	340	35000 30000	2200	F.T.	RUN	60	325	280
2700	F.T.	RUN	103	405	350							2550	F.T.	RUN	86	380	330	2400	F.T.	RUN	74	355	310	25000	2250	F.T.	RUN	57	300	260
2700	46	RUN	125	415	360	2500	F.T.	RUN	96	385	335	2350	F.T.	RUN	81	360	310	2200	F.T.	RUN	70	335	290	20000	1950	F.T.	RUN	53	280	245
2700	46	RUN	112	390	340	2400	42	RUN	92	365	315	2150	F.T.	RUN	77	340	295	2050	F.T.	RUN	68	315	275	15000	1750	F.T.	RUN	50	260	225
2700	46	RUN	100	365	315	2400	42	RUN	84	340	295	2150	40	RUN	74	320	280	1900	37	RUN	61	290	250	10000	1600	33	RUN	46	240	210
2700	46	RUN	94	335	290	2400	42	RUN	79	315	275	2100	39	RUN	66	290	250	1850	37	RUN	55	265	230	5000	1600	34	RUN	42	220	190
2700	46	RUN	86	315	275	2400	42	RUN	73	290	250	2100	39	RUN	60	265	230	1800	36	RUN	48	240	210	S.L.	1650	34	RUN	39	200	175

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 9400 LB. GROSS WEIGHT WITH 200 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 55 GAL.) TO FLY 900 STAT. AIRMILES AT 25,000 FT. ALTITUDE MAINTAIN 2400 RPM AND F.T. IN. MANIFOLD PRESSURE WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 11/20/44 BASED ON: *ESTIMATED AND WIND TUNNEL DATA*

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 27—Flight Operation Instruction Chart—Wing Racks

AAFMC-528 WF-3-31-44-10M 6-1-44

AIRCRAFT MODEL(S)
P-51H
ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,600 TO 9000 POUNDS

EXTERNAL LOAD ITEMS
2 - 500-LB. BOMBS
NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	61	LOW HIGH	RUN	15 MIN.		196 175

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II RANGE IN AIRMILES NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III RANGE IN AIRMILES NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
				SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]							
770	670	255			920	800	1020	880	255	1120	970
730	630	240			860	750	960	830	240	1060	920
670	580	220			790	690	880	760	220	970	840
600	520	200			720	620	800	690	200	880	760
540	470	180			650	560	720	620	180	790	690
480	420	160			570	500	640	550	160	700	610
420	370	140			500	440	560	480	140	610	530
360	310	120			430	370	480	410	120	530	460
300	260	100			360	310	400	350	100	440	380
240	210	80			290	250	320	280	80	350	300
180	160	60			210	190	240	210	60	260	230
120	100	40			140	120	160	140	40	170	150
60	50	20			70	60	80	70	20	90	70

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(3.6 STAT. (3.1 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(4.0 STAT. (3.4 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																				40000						
						35000																				35000						
2700	46	RUN	95	385	335	30000													2600	45	RUN	93	375	325	30000	2350	F.T.	RUN	73	320	280
2700	F.T.	RUN	102	370	320	25000													2550	F.T.	RUN	86	345	300	25000	2300	F.T.	RUN	66	290	250
2700	46	RUN	125	380	330	20000							2500	F.T.	RUN	96	350	305	2350	F.T.	RUN	79	325	280	20000	2100	F.T.	RUN	62	270	235
2700	46	RUN	112	355	310	15000							2200	F.T.	RUN	82	335	290	2150	F.T.	RUN	76	305	265	15000	1900	F.T.	RUN	59	260	225
2700	46	RUN	100	330	285	10000							2450	42	RUN	86	315	275	2150	39	RUN	72	290	250	10000	1800	36	RUN	56	245	215
2700	46	RUN	94	310	270	5000							2450	43	RUN	83	295	255	2150	40	RUN	68	270	235	5000	1800	36	RUN	51	225	195
2700	46	RUN	86	285	250	S.L.							2500	43	RUN	78	275	240	2050	39	RUN	59	250	215	S.L.	1800	36	RUN	47	205	180

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 10,400 LB. GROSS WEIGHT WITH 220 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 35 GAL.)
TO FLY 850 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 2150 RPM AND F.T. IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT.	PRESSURE ALTITUDE	F.R.	FULL RICH
M.P.	MANIFOLD PRESSURE	A.R.	AUTO-RICH
GPH	U.S. GAL. PER HOUR	A.L.	AUTO-LEAN
TAS	TRUE AIRSPEED	C.L.	CRUISING LEAN
KTS.	KNOTS	M.L.	MANUAL LEAN
S.L.	SEA LEVEL	F.T.	FULL THROTTLE

DATA AS OF 11/20/44 BASED ON: ESTIMATED AND WIND TUNNEL DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 28—Flight Operation Instruction Chart—500-pound Bombs

AAFMC-528 6-1-44

AIRCRAFT MODEL(S) P-51H ENGINE(S): V-1650-9	**FLIGHT OPERATION INSTRUCTION CHART** CHART WEIGHT LIMITS: 10,600 TO 9600 POUNDS	EXTERNAL LOAD ITEMS 2 - 75-GALLON COMBAT TANKS NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	61	LOW HIGH	RUN	15 MIN.		196 175

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE	NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
1280	1100	405			1550	1350	1720	1500	405	1900	1650
1190	1030	380			1460	1270	1620	1400	380	1790	1550
1130	970	360			1390	1210	1540	1340	360	1700	1470
1070	920	340			1320	1140	1480	1270	340	1610	1400
1000	870	320			1250	1080	1380	1200	320	1520	1320
940	810	300			1170	1020	1300	1130	300	1430	1240
880	760	280			1100	960	1220	1060	280	1340	1160
820	700	260			1030	890	1140	990	260	1250	1080
750	650	240			960	830	1060	920	240	1160	1010

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH.	T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH.	T.A.S. KTS.	(3.6 STAT. (3.13 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	(4.0 STAT. (3.48 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
						40000																			40000						
2700	46	RUN	103	405	350	35000																			35000						
2700	46	RUN	98	390	340	30000													2600	45	RUN	93	380	330	30000	2350	F.T.	RUN	72	325	280
2700	F.T.	RUN	103	380	330	25000													2600	F.T.	RUN	91	360	315	25000	2300	F.T.	RUN	66	295	255
2700	46	RUN	125	385	340	20000							2550	F.T.	RUN	101	365	315	2400	F.T.	RUN	86	340	295	20000	2100	F.T.	RUN	62	280	245
2700	46	RUN	112	360	315	15000							2450	43	RUN	96	345	300	2200	F.T.	RUN	80	320	280	15000	1900	F.T.	RUN	59	265	230
2700	46	RUN	100	340	295	10000							2550	44	RUN	92	330	285	2250	40	RUN	77	305	265	10000	1750	36	RUN	54	245	215
2700	46	RUN	94	320	280	5000							2450	43	RUN	83	305	265	2200	40	RUN	70	280	245	5000	1750	36	RUN	50	225	195
2700	46	RUN	86	295	255	S.L.							2550	44	RUN	80	285	250	2200	40	RUN	63	255	220	S.L.	1800	36	RUN	46	205	180

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 10,200 LB. GROSS WEIGHT WITH 340 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 65 GAL.)
TO FLY 1460 STAT. AIRMILES AT 25,000 FT. ALTITUDE
MAINTAIN 2600 RPM AND F.T. IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF *11/20/44* BASED ON: *ESTIMATED AND WIND TUNNEL DATA*

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 29 (Sheet 1 of 2 Sheets)—Flight Operation Instruction Chart—75-gallon Combat Tanks

AAFMC-528 4-1-44 M61-11-1-10M

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 9800 TO 8000 POUNDS

EXTERNAL LOAD ITEMS: 2 - 75-GALLON COMBAT TANKS

NUMBER OF ENGINES OPERATING:

LIMITS	RPM	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)
WAR EMERG.	Refer to Power Plant Charts, see Section III.							
MILITARY POWER	3000	61	LOW / HIGH	RUN	15 MIN.		196 / 175	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND[1]). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II RANGE IN AIRMILES NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III RANGE IN AIRMILES NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
800	690	255	920	800	1020	880	1120	970	255	1230	1070
750	650	240	860	750	960	830	1080	920	240	1180	1000
690	600	220	790	690	880	760	970	840	220	1080	920
630	540	200	720	620	800	690	880	760	200	980	840
580	490	180	650	560	720	620	790	690	180	870	750
500	430	180	570	500	640	550	700	610	180	770	670
440	380	140	500	440	560	480	610	530	140	670	590
380	330	120	430	370	480	410	530	460	120	580	500
310	270	100	360	310	400	350	440	380	100	480	420
250	220	80	290	250	320	280	350	300	80	380	330
190	160	60	210	190	240	210	280	230	60	290	250
120	110	40	140	120	160	140	170	150	40	190	170
60	50	20	70	60	80	70	90	70	20	90	80

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(3.6 STAT. (3.13 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(4.0 STAT. (3.47 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	(4.4 STAT. (3.82 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																				40000						
2700	46	RUN	103	415	360	35000													2600	F.T.	RUN	85	385	335	35000	2500	F.T.	RUN	72	340	295
2700	46	RUN	98	400	350	30000													2450	43	RUN	87	380	330	30000	2300	F.T.	RUN	67	325	280
2700	F.T.	RUN	103	385	335	25000							2600	F.T.	RUN	91	370	320	2450	F.T.	RUN	78	345	300	25000	2250	F.T.	RUN	61	295	255
2700	46	RUN	125	390	340	20000	2550	F.T.	RUN	101	370	320	2400	F.T.	RUN	87	350	305	2250	F.T.	RUN	74	325	280	20000	2000	F.T.	RUN	56	270	235
2700	46	RUN	112	365	315	15000	2450	43	RUN	96	350	305	2200	F.T.	RUN	82	330	285	2050	F.T.	RUN	69	305	265	15000	1800	F.T.	RUN	52	250	215
2700	46	RUN	100	340	295	10000	2600	44	RUN	95	335	290	2250	40	RUN	77	310	270	2000	38	RUN	65	285	250	10000	1600	34	RUN	49	235	205
2700	46	RUN	94	320	280	5000	2500	44	RUN	85	310	270	2250	40	RUN	73	290	250	1950	38	RUN	59	260	225	5000	1650	34	RUN	45	215	185
2700	46	RUN	86	295	255	S.L.	2600	44	RUN	82	290	250	2250	40	RUN	66	265	230	2000	38	RUN	55	240	210	S.L.	1700	35	RUN	42	200	175

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 9300 LB. GROSS WEIGHT WITH 200 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 55 GAL.) TO FLY 850 STAT. AIRMILES AT 25,000 FT. ALTITUDE MAINTAIN 2450 RPM AND F.T. IN. MANIFOLD PRESSURE WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
GPH : U.S. GAL. PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

DATA AS OF 11/20/44 BASED ON: ESTIMATED AND WIND TUNNEL DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

AAFMC-528 4-1-44

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 11,400 TO 10,000 POUNDS

EXTERNAL LOAD ITEMS: 2 - 110-GALLON COMBAT TANKS

NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	61	LOW HIGH	RUN	15 MIN.		196 175

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
1430	*1240*	475			1730	*1500*	1910	*1660*	475	2060	*1790*
1390	*1210*	460			1680	*1460*	1815	*1610*	460	2000	*1740*
1330	*1150*	440			1610	*1400*	1770	*1540*	440	1920	*1670*
1270	*1100*	420			1540	*1340*	1700	*1480*	420	1840	*1600*
1210	*1050*	400			1470	*1280*	1620	*1410*	400	1760	*1530*
1150	*1000*	380			1410	*1220*	1550	*1350*	380	1670	*1450*
1090	*950*	360			1340	*1160*	1470	*1280*	360	1590	*1380*
1030	*900*	340			1270	*1100*	1390	*1210*	340	1510	*1310*
970	*840*	320			1200	*1040*	1320	*1150*	320	1430	*1240*
910	*790*	300			1130	*980*	1240	*1080*	300	1350	*1170*
850	*740*	280			1070	*930*	1170	*1020*	280	1260	*1090*
790	*690*	260			1000	*870*	1090	*950*	260	1180	*1020*

MAXIMUM CONTINUOUS						PRESS	(STAT. (NAUT.) MI./GAL.)						(3.4 STAT. (2.95 NAUT.) MI./GAL.)						(3.8 STAT. (3.3 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
2700	46	RUN	98	375	325	30000																			30000	2400	F.T.	RUN	79	320	280
2700	F.T.	RUN	102	365	315	25000													2600	F.T.	RUN	89	340	295	25000	2450	F.T.	RUN	75	300	260
2700	46	RUN	125	375	325	20000							2550	F.T.	RUN	103	355	310	2450	F.T.	RUN	88	330	285	20000	2200	F.T.	RUN	70	285	250
2700	46	RUN	112	350	305	15000							2550	46	RUN	101	340	295	2200	F.T.	RUN	82	310	270	15000	2000	F.T.	RUN	66	270	235
2700	46	RUN	100	330	285	10000							2600	44	RUN	95	325	280	2250	40	RUN	77	295	255	10000	1900	37	RUN	61	250	215
2700	46	RUN	94	310	270	5000							2550	44	RUN	88	300	260	2200	40	RUN	71	270	235	5000	1900	37	RUN	56	230	200
2700	46	RUN	86	285	250	S.L.							2600	44	RUN	82	280	245	2250	40	RUN	66	250	215	S.L.	1900	37	RUN	50	205	180

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 11,800 LB. GROSS WEIGHT WITH 630 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 95 GAL.)
TO FLY 1700 STAT. AIRMILES AT 20,000 FT. ALTITUDE
MAINTAIN 2450 RPM AND F.T. IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF *11-20-44* BASED ON: *ESTIMATED AND WIND TUNNEL DATA*

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 30 (Sheet 1 of 2 Sheets)—Flight Operation Instruction Chart—110-gallon Combat Tanks

AAFMC-528 8-1-44

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,000 TO 8500 POUNDS

EXTERNAL LOAD ITEMS: 2 - 110-GALLON COMBAT TANKS

NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. SECT.III)
WAR EMERG.	Refer to Power Plant Charts, see Section III.							
MILITARY POWER	3000	61	LOW HIGH	RUN	15 MIN.		196 175	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]. TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I						FUEL	COLUMN II						COLUMN III						COLUMN IV						FUEL	COLUMN V					
RANGE IN AIRMILES						U.S.	RANGE IN AIRMILES						RANGE IN AIRMILES						RANGE IN AIRMILES						U.S.	RANGE IN AIRMILES					
STATUTE		NAUTICAL				GAL.	STATUTE		NAUTICAL				STATUTE		NAUTICAL				STATUTE		NAUTICAL				GAL.	STATUTE		NAUTICAL			
MAXIMUM CONTINUOUS						PRESS	(3.5 STAT. (3.0 NAUT.) MI./GAL.)						(3.85 STAT. (3.35 NAUT.) MI./GAL.)						(4.2 STAT. (3.65 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]																										
770		670				255	890		770				980		850				1070		930				255	1160		1000			
730		630				240	840		730				920		800				1010		870				240	1090		950			
670		580				220	770		670				850		730				920		800				220	1000		870			
610		530				200	700		610				770		670				840		730				200	910		790			
550		470				180	630		550				690		600				750		650				180	820		710			
490		420				160	560		480				610		530				670		580				160	730		630			
420		370				140	490		420				540		470				590		510				140	640		550			
360		320				120	420		380				460		400				500		430				120	540		470			
300		260				100	350		300				380		330				420		360				100	450		390			
240		210				80	280		240				310		270				330		290				80	360		310			
180		160				60	210		120				230		200				250		220				60	270		240			
120		100				40	140		120				150		130				170		140				40	180		160			
60		50				20	70		60				70		60				80		70				20	90		80			
2700	46	RUN	103	410	355	40000 35000																			40000 35000	2500	F.T.	RUN	73	330	285
2700	46	RUN	98	385	335	30000													2500	44	RUN	89	370	320	30000	2300	F.T.	RUN	69	315	275
2700	F.T.	RUN	102	375	325	25000													2500	F.T.	RUN	82	340	295	25000	2300	F.T.	RUN	64	290	250
2700	46	RUN	125	380	330	20000	2600	F.T.	RUN	105	365	315	2450	F.T.	RUN	90	345	300	2300	F.T.	RUN	77	320	280	20000	2100	F.T.	RUN	61	275	240
2700	46	RUN	112	360	310	15000	2500	44	RUN	100	345	300	2250	40	RUN	82	325	280	2100	F.T.	RUN	71	300	260	15000	1900	F.T.	RUN	57	260	225
2700	46	RUN	100	335	290	10000	2550	44	RUN	93	325	280	2250	41	RUN	79	305	265	2050	39	RUN	68	285	245	10000	1750	35	RUN	54	245	215
2700	46	RUN	95	310	270	5000	2550	44	RUN	86	305	265	2300	41	RUN	75	285	245	2050	38	RUN	62	260	225	5000	1750	35	RUN	49	220	190
2700	46	RUN	86	290	250	S.L.	2550	43	RUN	80	280	245	2250	41	RUN	68	260	225	2000	38	RUN	58	235	205	S.L.	1750	35	RUN	43	195	170

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 9000 LB. GROSS WEIGHT WITH 220 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 35 GAL.)
TO FLY 880 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 2250 RPM AND 40 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
GPH : U.S. GAL. PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

DATA AS OF 11/20/44 BASED ON: ESTIMATED AND WIND TUNNEL DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 30 (Sheet 2 of 2 Sheets)—Flight Operation Instruction Chart—110-gallon Combat Tanks

AAFMC-528 4-1-44

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 11,000 TO 9000 POUNDS

EXTERNAL LOAD ITEMS: 10 5-INCH ROCKETS

NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	61	LOW HIGH	RUN	15 MIN.		196 175

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]. TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II RANGE IN AIRMILES NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III RANGE IN AIRMILES NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV RANGE IN AIRMILES NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V RANGE IN AIRMILES NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
740	650	255			840	730	930	810	255	1020	880
700	610	240			790	690	870	760	240	960	830
640	560	220			730	630	800	700	220	880	760
580	510	200			660	570	730	630	200	800	690
520	450	180			590	510	650	570	180	720	620
470	400	160			530	460	580	500	160	640	550
410	350	140			460	400	510	440	140	560	480
350	300	120			390	340	440	380	120	480	410
290	250	100			330	280	360	320	100	400	350
230	200	80			260	230	290	250	80	320	280
170	150	60			200	170	220	190	60	240	210
110	100	40			130	110	140	120	40	160	140
60	50	20			60	50	70	60	20	80	70

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	(STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(3.3 STAT. (2.87 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	(3.65 STAT. (3.17 NAUT.) MI./GAL.) R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES	MIXTURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
2700	46	RUN	98	365	315	30000																			30000	2400	F.T.	RUN	80	315	275
2700	F.T.	RUN	102	355	310	25000													2600	F.T.	RUN	91	335	290	25000	2400	F.T.	RUN	72	285	245
2700	46	RUN	125	365	315	20000							2600	F.T.	RUN	107	350	305	2450	F.T.	RUN	89	325	280	20000	2200	F.T.	RUN	68	270	235
2700	46	RUN	112	340	295	15000							2550	44	RUN	101	330	285	2250	40	RUN	84	305	265	15000	2000	F.T.	RUN	65	255	220
2700	46	RUN	100	320	280	10000							2600	44	RUN	95	315	275	2350	41	RUN	81	295	255	10000	1850	37	RUN	59	235	205
2700	46	RUN	94	295	255	5000							2550	44	RUN	87	290	250	2300	41	RUN	75	270	235	5000	1900	37	RUN	56	220	190
2700	46	RUN	86	275	240	S.L.							2600	44	RUN	81	270	235	2250	40	RUN	67	245	215	S.L.	1900	37	RUN	50	200	175

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 10,800 LB. GROSS WEIGHT WITH 220 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 35 GAL.)
TO FLY 800 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 2250 RPM AND 40 IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
GPH : U.S. GAL. PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

DATA AS OF 11-20-44 BASED ON: *ESTIMATED AND WIND TUNNEL DATA*

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 31—Flight Operation Instruction Chart—Ten 5-inch Rockets

AAFMC-528 6-1-44 WPF-5-31-44-10M

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 11,500 TO 10,500 POUNDS

EXTERNAL LOAD ITEMS
2 - 75-GALLON TANKS
AND 6 - 5-INCH ROCKETS
NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	61	LOW HIGH	RUN	15 MIN.		196 175

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]. TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
1190	1010	405			1410	1220	1530	1330	405	1640	1420
1080	940	380			1330	1150	1440	1250	380	1540	1340
1030	890	360			1260	1090	1370	1190	360	1460	1260
970	840	340			1190	1030	1300	1130	340	1380	1200
910	790	320			1130	980	1220	1060	320	1300	1130
860	740	300			1060	920	1150	1000	300	1230	1070
800	690	280			1000	870	1080	940	280	1150	1000
740	640	260			930	810	1010	860	260	1070	930
690	600	240			860	750	940	810	240	1000	870

MAXIMUM CONTINUOUS						PRESS	(STAT. (NAUT.) MI./GAL.)						(3.3 STAT. (2.85 NAUT.) MI./GAL.)						(3.6 STAT. (3.1 NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000 35000 30000																			40000 35000 30000						
2700	F.T.	RUN	102	340	295	25000													2600	F.T.	RUN	89	320	280	25000						
2700	46	RUN	125	355	310	20000							2550	F.T.	RUN	100	330	285	2400	F.T.	RUN	85	305	265	20000						
2700	46	RUN	112	335	290	15000							2500	43	RUN	98	320	280	2200	F.T.	RUN	82	295	255	15000	2050	F.T.	RUN	68	260	225
2700	46	RUN	100	315	275	10000							2550	44	RUN	92	305	265	2300	41	RUN	80	285	250	10000	1950	37	RUN	62	240	210
2700	46	RUN	94	290	250	5000							2550	44	RUN	87	285	250	2250	40	RUN	72	260	225	5000	1900	37	RUN	57	220	190
2700	46	RUN	86	270	235	S.L.							2500	43	RUN	79	260	225	2250	41	RUN	67	240	210	S.L.	1950	37	RUN	53	205	180

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 11,280 LB. GROSS WEIGHT WITH 360 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 45 GAL.)
TO FLY 1350 STAT. AIRMILES AT 28,000 FT. ALTITUDE
MAINTAIN 2400 RPM AND F.T. IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 11-20-44 BASED ON: ESTIMATED AND WIND TUNNEL DATA

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 32 (Sheet 1 of 2 Sheets)—Flight Operation Instruction Chart—75-gallon Combat Tanks, and Six 5-inch Rockets

AAFMC-528 4-1-44

AIRCRAFT MODEL(S): P-51H

ENGINE(S): V-1650-9

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 10,500 TO 9000 POUNDS

EXTERNAL LOAD ITEMS: 2 - 75-GALLON TANKS AND 6 - 5-INCH ROCKETS

NUMBER OF ENGINES OPERATING:

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	Refer to Power Plant Charts, see Section III.						
MILITARY POWER	3000	61	LOW / HIGH	RUN	15 MIN.		196 / 175

FOR DETAILS SEE POWER PLANT CHART SECT. III (FIG.)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
730	630	255	870	730	920	790	1000	860	255	1060	920
690	600	240	790	680	860	750	930	810	240	1000	860
630	550	220	720	630	790	680	860	740	220	910	790
570	500	200	660	570	720	620	780	670	200	830	720
510	450	180	590	510	650	560	700	610	180	750	650
460	400	160	530	460	570	500	620	540	160	660	570
400	350	140	460	400	500	430	540	470	140	580	500
340	300	120	390	340	430	370	470	400	120	500	430
290	250	100	330	280	360	310	390	340	100	410	360
230	200	80	260	230	290	250	310	270	80	330	290
170	150	60	200	170	210	190	230	200	60	250	210
110	100	40	130	110	140	120	150	130	40	160	140
60	50	20	60	50	70	60	80	70	20	80	70

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(3.3 STAT. (2.85 NAUT.) MI./GAL.)						(3.6 STAT. (3.1 NAUT.) MI./GAL.)						(3.9 STAT. (3.4 NAUT.) MI./GAL.)						PRESS ALT. FEET	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. G.P.H.	APPROX. T.A.S. M.P.H.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
2700	F.T.	RUN	102	350	305	25000													2500	F.T.	RUN	82	315	275	25000						
2700	46	RUN	125	360	310	20000	2550	F.T.	RUN	104	340	295	2450	F.T.	RUN	89	320	280	2300	F.T.	RUN	77	295	255	20000						
2700	46	RUN	112	340	295	15000	2500	43	RUN	99	325	280	2250	40	RUN	84	305	265	2100	F.T.	RUN	74	285	250	15000	1950	F.T.	RUN	62	255	220
2700	46	RUN	100	320	280	10000	2550	44	RUN	93	310	270	2350	41	RUN	83	295	255	2100	39	RUN	70	270	235	10000	1850	36	RUN	58	240	210
2700	46	RUN	94	295	255	5000	2550	44	RUN	88	290	250	2300	41	RUN	75	270	235	2050	38	RUN	63	245	210	5000	1800	36	RUN	52	215	185
2700	46	RUN	86	275	240	S.L.	2550	44	RUN	79	265	230	2300	41	RUN	70	250	215	2050	38	RUN	57	225	195	S.L.	1850	36	RUN	4	200	175

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG.)
PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

HIGH BLOWER ABOVE HEAVY LINE

EXAMPLE

AT 10,300 LB. GROSS WEIGHT WITH 220 GAL. OF FUEL
(AFTER DEDUCTING TOTAL ALLOWANCES OF 35 GAL.)
TO FLY 900 STAT. AIRMILES AT 15,000 FT. ALTITUDE
MAINTAIN 1950 RPM AND F.T. IN. MANIFOLD PRESSURE
WITH MIXTURE SET: RUN

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
GPH : U.S. GAL. PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

DATA AS OF 11-20-44 BASED ON: *ESTIMATED AND WIND TUNNEL DATA*

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure 32 (Sheet 2 of 2 Sheets)—Flight Operation Instruction Chart—75-gallon Combat Tanks, and Six 5-inch Rockets